SCIENTIFIC AMERICAN

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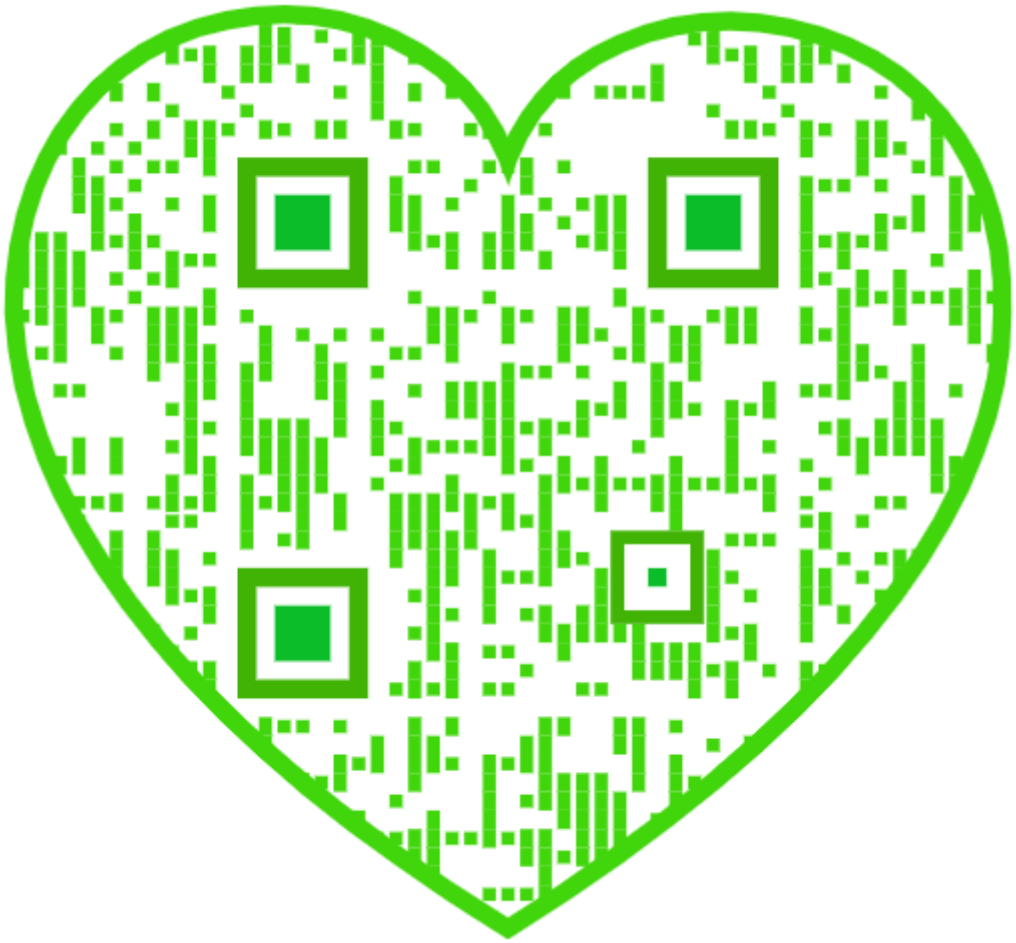
Vol. LXXXVI.—No. 12. ESTABLISHED 1845. NEW YORK, MARCH 22, 1902. $3.00 A YEAR. 8 CENTS A COPY

THREE-CYLINDER COMPOUND ENGINES OF THE NEW YORK EDISON POWER STATION.—[See page 205.]

One high-pressure cylinder, 43½ inches diameter; two low-pressure, 75½ inches diameter; stroke, 5 feet.



SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

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Scientific American (Established 1845) ..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885) ..... 2.50 "
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MARCH 22, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE NEW ERA FOR THE STEAM ENGINE.

Unquestionably, in the development of the steam engine, we are just now entering upon a new era, which, when steam has ceased to be used as a prime mover, and the history of the age of steam comes to be written, will be distinguished sharply from the first era, which is now apparently drawing to a close. To Watt, we take it, must always belong the credit of having opened, in a practical way, the era of the reciprocating steam engine, and to Parsons will belong the credit of being the first to demonstrate in a commercial sense that the term of usefulness of the reciprocating engine was, at least for the majority of uses to which it has been put, drawing to a close, and that the era of the simpler and more efficient turbine had arrived. In saying this we would be careful to emphasize the fact that as long as steam continues to be used, the reciprocating engine will, for some classes of work, continue to be the most serviceable motor. To particularize, we have only to refer to the steam locomotive, to convince everyone who is familiar with the demands and exigencies of locomotive service, that the turbine is never likely to displace the reciprocating engine in this class of work.

As an electrical drive, however, it is pre-eminently qualified, and since electrical power seems destined to indefinitely enlarge its field of application, the growth of the steam turbine in connection with the electrical industries is destined to be rapid and widespread. But although the turbine is not applicable directly to the locomotive and the street car, it is the ideal motor for the propulsion of steamships. This is said with a full appreciation of the fact that there are difficulties of reversing which limit the maneuvering power of a ship in entering or leaving a dock, or in making landings; for this objection has been largely overcome by the provision of separate reversing motors. In any case, the difficulty is so greatly outweighed by the economy of the turbine in weight and fuel, and by the advantages of a complete absence of vibration, that we look to see the steam turbine enjoy a monopoly, as a marine engine, second only to that which it will achieve in connection with electrical power on land. Indeed, the only classes of work to which the turbine may not prove to be immediately applicable are those which involve much starting and stopping, and considerable running at slow and intermediate speeds. In work of this kind the reciprocating steam engine will always find a limited sphere of usefulness, unless, indeed, even here it is driven out by the ubiquitous electric motor.

The advance of the steam turbine during the past few months, both in size and power, and in its application to large plants, has been quite remarkable. Two of the largest manufacturing concerns in this country have been for some years watching closely its development, and have themselves been conducting experimental work to determine its efficiency and to improve upon existing forms. Although the Parsons turbine is an English invention, and practically all the work with large units that has been accomplished has been done by these machines, it is a fact that the Westinghouse Company, which secured the rights for the Parsons turbine in this country, has already built, or is now building, eight turbines of from 750 to as high as 2,500 horse power. These Westinghouse-Parsons machines, as they are called in this country, have been giving most excellent results, and the 2,500 horse power turbine, which has now been employed for about a year in an electric light and power plant at Hartford, Conn., is the largest turbine and probably the most economical steam engine in the world. In addition to these machines, we understand that the same company has received an order for a large turbine for South Africa, which is to be used in a big power-transmission scheme that is being worked out in the Rand gold fields. The General Electric Company have in operation at their works a 750-horse power turbine of the bucket-and-nozzle type, the plans for which have been worked out by the company's engineers. This turbine has also shown excellent economy, and we understand that the company stands ready to manufacture it upon a commercial scale.

Most significant fact of all, pointing to the ultimate monopoly of the steam engineering field by the new type of engine, is the confidence with which the great railway and power companies are adopting the turbine in large units as a drive for electrical generators. We referred last week to the fact that the London underground railways were equipping a 100,000 horse power plant with ten 10,000 horse power turbines. We are now able to announce that it is only the conviction that nothing of an experimental nature must be allowed to enter into the equipment of the new Rapid Transit Subway's power plant that prevents its equipment with the steam turbine. As it is, only six engines of the reciprocating type have been ordered, and the balance of the order has been left open with the expectation of installing the turbine when there is a demand for the full power of the station. Reference was also recently made in these columns to the probability of the new 25-knot liners for the Cunard Company being driven by turbine engines, while a sister ship to the turbine passenger steamer "King Edward," which did such good work on the Clyde last year, is under construction, and three large steam yachts have also been ordered in Great Britain which are to be equipped with the same motive power. Incidental evidence of the widespread appreciation of the fact that we are on the eve of revolutionary changes in motive power came to our notice the other day in the case of one of the largest steam yachts that has ever been planned in this country. At the eleventh hour the owner requested that the plans be held in abeyance for another season until the performance of the new British turbine-propelled yachts could be noted.

TEMPORARY RELIEF AT THE BROOKLYN BRIDGE.

For want of the necessary farsightedness on the part of city officials and the heads of the great railroad companies, New York city is confronted with a series of deadlocks in its transportation which are bad enough to-day, and promise to be considerably worse in the future. One of these is occasioned by the notorious Grand Central tunnel and the wretchedly inadequate facilities of the Grand Central Station terminal yard. For this condition of things there is nobody to thank but the Directors of the road, who, rather than make the necessary expenditure in an experimental equipment looking to the electrification of the road, allowed matters to drift to their present intolerable condition. Other deadlocks are to be found at the various points of concentration in the traffic of the Manhattan Elevated Railroads. The City Hall terminal, the transfer station at Harlem River, the express trains on the Ninth Avenue, and the whole stretch of Sixth Avenue, from near the Battery to above the Park, witness, morning and night, a condition of crowding and jostling which can only be matched in the mad struggle of the occupants of a stockyard train at Omaha or Chicago. Here again the intolerable conditions would never have been reached had the railroad company instituted the present changes in motive power some three or four years ago, when the state of the electrical art was quite sufficiently advanced to warrant the change. As an instance of what an aggressive and broad-minded company can accomplish in the struggle to meet the ever-rising tide of travel, we turn with pleasure to the work of the Metropolitan Street Railway Company, who alone seem to have provided for the increasing travel of the future, and have at all times had under way great and costly changes in equipment, which have enabled the company to handle its traffic under conditions that are crowded, but by no means intolerable.

Of all congested centers in the city, unquestionably the worst is the Manhattan terminus of the trolley roads that cross the Brooklyn Bridge. Here, during the past few weeks, it has been a not infrequent occurrence for passengers to be thrown down and so seriously injured as to necessitate their removal to a hospital. Indeed, it was only last week that a policeman that stood six feet something in his stockings was himself dragged unconscious from the crowd. Bridge Commissioner Lindenthal, who has been devoting constant attention to this problem ever since he took office, has recently presented a plan looking not merely to the relief of the Brooklyn Bridge, but to the proper handling of the travel over the bridges which are now under construction. His plan involves the purchase of the block on which the offices of the Staats Zeitung are located, and its conversion into a great terminal yard for the use of bridge trains and surface cars. This improvement, together with the running of the Brooklyn Bridge tracks by way of an elevated structure to the terminus of the two new East River bridges, would involve an outlay of something like $14,000,000, and it is likely that the great cost of the scheme, excellent as it otherwise is, will prevent its adoption.

In any case it is imperative, pending the carrying out of a scheme of relief on a large and permanent basis, to devise some emergency measures which will give immediate relief at the Brooklyn end of the Bridge. The plan proposed by the Bridge Commissioner is to provide a series of loops in the Bridge Plaza at Brooklyn, and run, during rush hours, a series of circulating trolleys over the Bridge, these trolleys to use the new loops on the plaza and the present four loops at the Manhattan end of the Bridge exclusively. Extra loops are to be laid at the Manhattan end of the Bridge, which will be used exclusively for through trolley service. It is estimated that this plan, by greatly increasing the number of trolleys that can pass over the Bridge in a given time, will provide a relief which will make conditions tolerable until a more comprehensive scheme can be devised and put through. The two extra loops could be put down in three or four weeks' time, and by using timber in place of structural steel, as the Commissioner suggests, the necessary changes at the Bridge terminal could be carried out very expeditiously. It certainly seems to us that this emergency plan is about the best that can be devised under the circumstances.

USE OF VARIOUS MOTORS IN AEROSTATICS.

M. Armengaud, Jr., in a paper which he read lately before the Société Civile upon the progress of aerial navigation and the experiments of Santos-Dumont, passes in review the different sources of motive power which are applicable to dirigible balloons, namely, steam, electricity, and explosion motors. As concerns the steam engine, as long as the aerostat is filled with hydrogen it would be imprudent to carry in the car a furnace or burner whose sparks could produce the inflammation of the gases and the explosion of the balloon. Nevertheless, if it were possible to isolate sufficiently the balloon from the car, or to make the former of incombustible material, the danger would be warded off. In the case of the steam engine there is to be considered the weight corresponding to the supplies. This weight is considerable, since it necessarily includes the water and combustible. M. Serpollet, the inventor of the steam system so successful for traction cars and automobiles, says that with his system of flash-tube boiler he is able to reduce to 420 pounds the weight of a machine giving 30 horse power, or 14 pounds per horse power, but it must carry 2½ gallons of water, which would be too heavy a load for the balloon. Perhaps the weight could be reduced still further by replacing the engine by a steam turbine of the Laval or Parsons type. As to electricity as a source of motive power, he mentions that Renard and Krebs in their experiments of 1884 succeeded in reducing the weight of the battery to 880 pounds for a motor giving 9 effective horse power. In this weight of 880 pounds is no doubt included the motor which was constructed by Capt. Krebs and weighed only 22 pounds; this figure has not been diminished since. As to the question of explosion motors, the author considers briefly the history of their development since Lenoir and Hugon, down to the modern forms of Daimler, Panhard and De Dion. It has been necessary to arrive at great speeds in order to utilize to advantage the heat-producing power of the fluid combustible. From 160 revolutions per minute at first, we have now reached 1,600 or more, and it is understood that by thus increasing the speed we obtain ten times the power for a given weight, or what is more interesting here, we diminish the weight ten times for the same power. This lightness may again be increased by reducing the dimensions of certain organs and by using materials which are sufficiently resistant with a small weight; thus steel may be used instead of cast iron, aluminium for the parts which do not work, etc.

The development which has taken place in France in the construction of motors for automobiles pushed the constructors to make motors as light as possible for the class of automobiles known as voiturettes and light vehicles. The De Dion type of motor is a good example of a successful light motor, and this type is now used, with modifications, by many other constructors. Before the experiments of Santos-Dumont it does not appear that aeronauts have been greatly encouraged to use the explosion motor, but it may be remarked that since the time he began his experiments, which is several years ago, the motors have been greatly improved. Among the motors which are now in competition for lightness and power may be cited the Buchet (which is the type last used by Santos-Dumont), the Mors, and the Panhard and Levassor, which arrives at 11 pounds per horse power. A new type is the Bourdiaux, in which the radiating circles on the cylinder are of aluminium and which weighs only 7.7 pounds per horse power for sizes ranging from 10 to 25 horse power and 7.3 pounds from 25 to 50 horse power. For experiments of short duration the aeronaut must add about 1-10th of the weight of the motor for gasoline, and for a voyage of 10 hours it would require the same weight for gasoline as for the motor. As regards the stability of the balloon it would be preferable if the diminution of weight due to the burning of the combustible were compensated by a decrease in the ascensional force. This could be brought about in other ways than by letting the hy-

drogen escape, for instance, by taking in the atmospheric air and compressing it in a reservoir or by using a rudder placed in the horizontal sense.

INCOMES OF SUCCESSFUL INVENTORS.

BY ANSLEY IRVINE.

It is generally believed that inventors are an unfortunate class of individuals who struggle through life surrounded by an unsurmountable barrier of penury and misfortune. This, doubtless, is true of many cases, but the obverse of the picture is gratifying and full of encouragement. Innumerable instances could be given where comparatively large fortunes have been made out of a simple article, which necessitated neither elaborate design nor great initial expenditure, and, when judged from a strictly utilitarian point of view, did not possess any practical value.

Some of the largest fortunes appear to have been derived from the invention of trivialities and novelties, such as the once popular toy known as "Dancing Jimcrow," which for several years is said to have yielded its patentee an annual income of upward of $75,000. The sale of another toy—"John Gilpin"—enriched its lucky inventor to the extent of $100,000 a year as long as it continued to enjoy the unexpected popularity that greeted it when first placed upon the market. Mr. Plimpton, the inventor of the roller skate, made $1,000,000 out of his idea, and the gentleman who first thought of placing a rubber tip at the end of lead pencils made quite $100,000 a year by means of his simple improvement.

When Harvey Kennedy introduced the shoe-lace he made $2,500,000, and the ordinary umbrella benefited six people by as much as $10,000,000. The Howard patent for boiling sugar *in vacuo* proved a lucrative investment for the capitalists, who were able to remunerate the inventor on a colossal scale. It is estimated that his income averaged between $200,000 and $250,000 per annum. At first the process proved an entire failure and had to be laid aside as useless. It was not until an old German workman casually made a suggestion for a possible improvement that it was once more tried. The suggestion was improved upon and the invention rendered successful. All sugar refiners who used the new method allowed Mr. Howard a royalty of twenty-four cents per hundredweight on the raw material passing through the process.

Sir Josiah Mason, the inventor of the improved steel pen, made an enormous fortune, and on his death English charities benefited by many millions of dollars. He was one of the most generous of men, and during his life gave enormous sums to hospitals and industrial schools. The patentee of the pen for shading in different colors derived a yearly income of about $200,000 from this ingenious contrivance. It is stated that the wooden ball with an elastic attached yielded over $50,000 a year. Many readers will remember a legal action which took place some years ago, when in the course of the evidence it transpired that the inventor of the metal plates used for protecting the soles and heels of shoes from wear sold 12,000,000 plates in 1879, and in 1887 the number reached a total of 143,000,000, which realized profits of $1,150,000 for the year.

Women seem also to possess the inventive faculty, and, indeed, they must find plenty of scope for new ideas, as there are hundreds of little things waiting to be superseded by simple appliances that will minimize handwork and obviate the necessity of so much toil being daily expended in the household. The lady who invented the modern baby carriage enriched herself to the extent of $50,000; and a young lady living at Port Elizabeth, South Africa, devised the simple toilet requisite, known as the "Mary Anderson" curling iron, from which she derives royalties amounting to $500 a year. It was the wife of a clergyman who designed an improvement for the corset and made a fortune out of it. Instances of ladies bringing forward inventions which have added to personal comfort and general utility could be given *ad infinitum*. They occupy all ranks of society, from the poor struggling seamstress to the Empress of France, who, by the way, invented a dress improver, which years ago developed into the then fashionable crinoline. The gimlet-pointed screw, the idea of a little girl, brought many millions of dollars to the clever inventor. Miss Knight, a young lady of exceptional talents, was gifted with wonderful mechanical powers, as will be seen by the complicated mechanism of her machine for making paper bags. We are told she refused $50,000 for it shortly after taking out the patent.

The history of the wire-wound gun, which was invented by Mr. J. Longridge, the famous engineer, throws some light on the *insouciance* and apathy that formerly enveloped the British War Office. Longridge invented the gun in 1854, and did all in his power to place it before the authorities, but they would have nothing to do with it. Thirty years afterward, however, the Ordnance Department at Woolwich subjected one of the guns to exhaustive tests, and so satisfactory were the results that they declared that nothing could equal it for heavy ordnance. Unfortunately, the inventor died from a broken heart before this end was attained. Another case illustrating the treatment sometimes meted out to inventors by the English War Office is that of Dr. Conan Doyle, the popular author of "Sherlock Holmes," who recently discovered a way to insure approximate accuracy in high-angle or dropping rifle fire, the need of which has so often been felt in the present war in the Transvaal. The inventor states that the apparatus would be fitted to the rifle and would weigh comparatively nothing, cost but a few cents, take up very little space, and interfere in no way with the present sights. The novelist communicated with the officials in London and received the following reply: "With reference to your letter concerning an appliance for adapting rifles to high-angle fire, I am directed by the Secretary of State to inform you that he will not trouble you in the matter." As Dr. Doyle remarks, the invention might be absolute rubbish or it might be epoch-making, but he has been given no chance of either explaining or illustrating it.

The machine with which the Brothers Morley, in the latter years of the eighteenth century, made their enormous fortune was the stocking loom, invented three generations earlier by the Rev. William Lee, a Fellow of St. John's College, Cambridge, England. Lee's life-story is full of sadness. According to one account Lee, falling in love with and marrying an innkeeper's daughter, lost his Fellowship, and was consequently reduced to extreme poverty. The wife knitted stockings for a living, and the husband, sitting by her side as she worked, watched the intricate movements of her hands, and was thereby led to speculate on the possibility of constructing a machine that would do the work more expeditiously. Lee came to grief, because his machine was believed to be a device for throwing people out of employment. He went ultimately to France, where he died poor and friendless, a disappointed man. Many years afterward English legislators so appreciated the value of the stocking loom that they prohibited its exportation; and so jealous was Parliament of foreign competition that it seems to have been doubtful, even as late as the middle of the eighteenth century, whether it was lawful even to publish a technical description of the apparatus. When the frame was introduced it completely revolutionized the stocking trade, producing fifteen hundred loops per minute as against the hundred loops in skilled hand-knitting.

It is difficult to realize that the art of perforating paper was unknown fifty years ago. Prior to 1854 postage stamps were issued in sheets, the purchaser having to cut them up in the way he found most convenient. In 1848 an Irishman named Archer introduced a machine for cutting small slits round each stamp. This was tried by the English postal authorities, but for some unexplained reason it did not work to their satisfaction, and, notwithstanding that Archer went to great trouble and expense in altering the machine so as to meet the objections, it was refused by the government. Archer then constructed an entirely new machine which cut out circular holes. He received sufficient encouragement to induce him to still improve his invention, when, in 1851, after three years' continual labor, the Treasury proposed to buy the patent rights for $3,000. This parsimonious offer was, of course, refused, as Archer had spent considerably more than this on his various experimental machines. Eventually the matter was placed before the Select Committee of the House of Commons, and the pertinacious inventor was awarded $20,000, which, considering his apparatus in a few years saved the government many thousands of dollars, was not excessive.

Liverpool, England.

LEAD MINING IN WISCONSIN.

About the year 1824, some thirty-six years before the coming of the first pioneers, lead was first mined in Wisconsin. Although the original lead miners were chiefly Americans, Cornishmen, driven out of England by low wages, soon entered the field. Reports which they sent home to their relatives and friends of the richness of the American lead-mining district soon brought an army of Cornishmen to Wisconsin. Skilled in deep mining as they were, these men from Cornwall were a valuable acquisition to the newly-opened region. Americans engaged chiefly in superficial mining, and when the results were not equal to their expectations, proceeded elsewhere. The Cornishmen, on the other hand, appropriated the claims left by their predecessors, worked them, and found ore enough to give work to many men.

In southwestern Wisconsin lead mining differs much from that in other parts of the State, since the lead was found nearer the surface. For that reason the work has received the name of "diggings" to distinguish them from the mines. The diggings were not worked deeply enough. Two men, whenever they opened a pit, would find "pay" almost immediately. A pit once exhausted or difficult to follow, because the vein led back too far, was abandoned. So numerous and so certain and immediate were the results of working these diggings that few of the men labored for wages.

The Cornishmen who emigrated to Wisconsin were not prospectors in the American acceptation of that term. Accustomed as they were to working for wages in their own country, they lacked the enterprise and energy so characteristic of the American miner. But they were steadier and more pertinacious in their work. Rarely indeed could an American be induced to work a claim after he had reached hard rock. But the Cornishman worked the abandoned rock until the mineral was exhausted, and thus earned for himself the title of a "hard-rock miner."

SCIENCE NOTES.

E. Bourquelot recommends, as a test for the presence of cane sugar, the use of the invertin of yeast, which doubles cane-sugar. It has also the same effect on gentianose and raffinose; but these carbohydrates are rare in plants. By this means he has determined the presence of cane-sugar in the rhizome of *Scrophularia nodosa*, in the succulent pericarp of *Cocos yatai* (25 gm. per kilo.), and in the horny endosperm of *Asparagus officinalis* (15 gm. per kilo.). In neither of the two latter plants was the reaction with emulsin obtained, showing the absence, in these organs, of a glucoside which is doubled by that ferment.—Comptes Rendus.

Writing from Sierra Leone, under date of November 26, 1901, Consul Williams says: "The superintendent of Mahometan education for British West Africa—whose work extends from the hinterlands of Sierra Leone to the Niger—visited this consulate recently and requested that I procure from American publishers catalogues and specimen pages of common-school textbooks in the English language for his examination, with a view to their introduction and use in the schools under his supervision, if satisfactory. Much interest is being manifested by the colonial government at present in Moslem education. This being, perhaps, the first opportunity for the introduction of American text-books into this country, it is very important that those concerned respond promptly. Literature may be sent to this consulate."

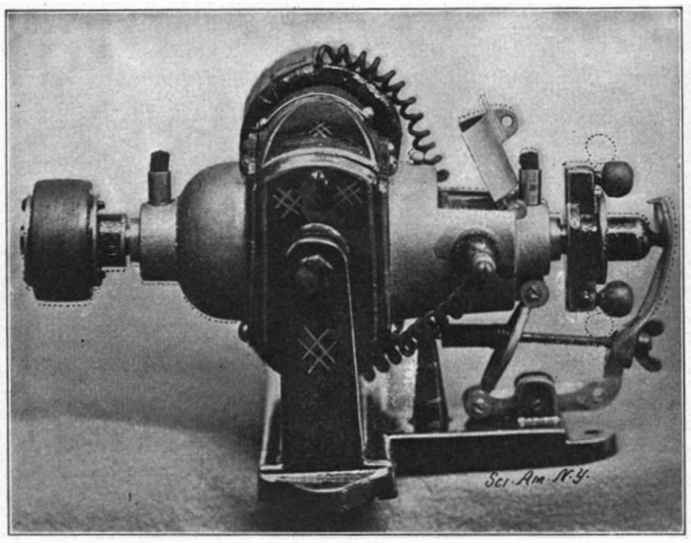
Prof. Alexander Agassiz is in charge of an expedition to the Maldive Islands in the Indian Ocean which has recently been sent from the Agassiz Museum at Harvard. Prof. Agassiz fitted out the expedition and is assisted by W. McM. Woodworth. They expect to find rare and beautiful coral formations and will gather as exhaustive a collection as possible. A steamer was chartered at Colombo, Ceylon, from the British India Company, to transport the expedition to the southern part of the Indian Ocean, where the Maldive Islands lie. The islands of the Indian Ocean are the only group remaining which Mr. Agassiz has not examined in his explorations for the study of coral. The islands are remote and unfrequented, and it is expected that the expedition will prove fruitful. The work will occupy about two months.

Leather, even when soft, does not present itself to the mind as a particularly good filtering medium; indeed, it might seem just the reverse; so one must commend Mr. W. G. Stratton for noting his experience with it in the Chemist and Druggist. The so-called chamois skin is there recommended as an excellent medium for the clarification of thick liquids. The leather is to be well rinsed in cold water, he says, and after being wrung to express the excess of moisture it should be affixed to the top of the funnel so as not to hang down very deeply. Small clothes-line pegs are useful for this purpose. Immediately after use, the chamois should be well washed and carefully dried. The same piece may thus be kept serviceable for a large number of filtrations.

In a reply to a letter, asking the cause of autumn haze, the Chief of the United States Weather Bureau recently prepared a letter, part of which is quoted in what follows: The dry haze is undoubtedly due to fine particles of dust. The finest dust is composed of one or all of the following substances, namely, fine particles of soil or the dead leaves of plants, smoke or ashes from wood fires, salt from ocean spray, the shells or scales of microscopic silicious diatoms, germs of fungi, spores of ferns, pollen of flowers, etc. In the still air of the damp nights these dust particles settle slowly down, and the morning air is comparatively clear. During the daylight the sun warms the soil, which heats the adjacent air, and the rising air currents carry up the dust as high as they go. Under certain conditions which are named in the letter the layer of dust reaches higher and higher every successive day. During long, dry summers in India it reaches to 7,000 feet with a well-defined upper surface that is higher in the daytime than at nighttime. This is a general explanation of dry haze weather and applies to Indian summer also. The reason why we have more of such weather in the autumn is because there is then less horizontal wind and less rising air.

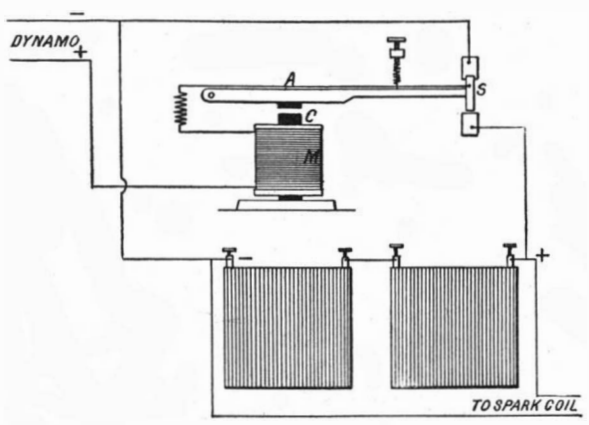
THE MOTSINGER IGNITION DYNAMO.

This is a strong, well-built, inclosed dynamo for ignition purposes. It was the first successful little machine of its kind to be used in America, and it has been so well thought of by the French firm of Panhard & Levassor that they have secured the patent rights in their country and are equipping their machines with it. A new type of governor has recently been brought out, and it is plainly shown in the illustration. The dynamo is set under the flywheel and its pulley is driven by friction with the latter. When it has reached the proper speed the governor balls are thrown out by centrifugal force and bell cranks attached to them push the sleeve on the end of the shaft against the curved spring attached to the lever pivoted on the dynamo base. This forces the outer end of the lever downward and raises the inner end, which is yoked to the governor sleeve, and which therefore tends to tip up this end of the machine, since the whole dynamo is pivoted on its transverse axis. The result is that the pulley moves away from the flywheel, and the whole machine assumes the position shown by the dotted lines until it drops back to speed. By employing this governing arrangement, it is possible to start the engine with ease when turning it by hand, and yet not damage the dynamo from excessive speed while the engine is running. The speed of the latter can be varied also without affecting the spark produced. The door in the casing allows of examination of the brushes, and the dynamo can be made to operate over the flywheel by changing the yoke to the hole near the outer end of the lever on the base.



THE MOTSINGER IGNITION DYNAMO.

The diagram shows an automatic switch arrangement for employing the dynamo in connection with two cells of storage battery. The storage battery furnishes the electricity for the spark and thus allows one to start the engine when turning it over slowly. As soon as the engine starts and the dynamo begins to generate, current from the latter will pass through the electro-magnet, *M*, and cause the core, *C*, to attract the armature, *A*, thus throwing the switch arm, *S*, on the lower contact, which is connected to the + pole of the battery. The dynamo current will then pass through the battery and back to the — pole of the dynamo. A great advantage of this arrangement is that the battery is always kept charged and so can be called upon to supply current for testing the wiring, or for operating the spark should the dynamo get out of order. Two small 10 or 15 amperé-hour cells are all that are necessary.



AUTOMATIC SWITCH FOR CHARGING STORAGE BATTERIES.

THE COMPUTING TRIANGLE.

BY B. M. DES JARDINS.

This instrument was designed to solve the problem of justifying type. It is practically adapted to automatic machine computation, on account of the equal distances of its graduations making it easily operated by the simple step-by-step motion. Its mathematical possibilities are large, as it possesses all of the qualities of the triangle for purposes of computing problems.

Its capacity for performing examples in addition and subtraction would be better shown by other forms of construction; the present construction, however, illustrates the underlying principle employed for performing examples. This construction is peculiarly adapted for adding and subtracting proportional amounts.

For simple addition or subtraction use the eccentric controlling the movable caliper jaw, displacing it by the addition or subtraction of the required amounts, one after the other.

For proportional addition or subtraction the successive amounts may be added or subtracted by means of the scale and eccentric controlling the angle, the amount of the proportion being controlled by the position of the stop along the lower scale. If it is required to vary the proportion while the process of addition or subtraction is going on, the variation is made on the lower scale either direct or by means of its eccentric.

In machine subtraction among others it performs such examples as would be necessary to reduce the end of a rod a given number of steps. Set the lower jaw, on its scale, a distance equal to the smaller size, then caliper the rod with the upper jaw, and when in this position set the angle in accordance with the number of steps wanted; set the stop on the lower scale till the parts are tight, then set the angle successively at the various figures or positions of its scale proportional to the steps wanted, and each position will locate the jaws at the successive positions required to caliper the metal as it is turned down.

Examples in division may be performed in either positive or negative quantities. The pivotal point of the angle represents 0, the right or upper arm is used for positive quantities, the left or lower arm for negative quantities.

The lower caliper jaw is adjustable for two purposes; it is necessarily set on the lower scale when the upper jaw is used in gaging negative quantities, and it is always set on the lower scale to designate the part of the substance upon which no example is performed. For simple examples in division the dividend, or amount to be divided, is designated by the position of the upper caliper jaw, which is adjusted according to the number and fraction required by means of its scale and segment. The amount of the division is then designated by the position of the angle by means of its scale and segment. Having located these two elements, the quotient is located by the position of the stop block against the angle and the amount is designated by means of its scale, and the remainder is then determined by the position of its segment. By means of this instrument, fractions of any nature may be divided with the same ease as simple numbers. The segments in each case readily locate the intermediate positions of the instrument. For multiplication the stop is located according to the amount to be multiplied by means of its scale and segment. The angle is then set in a similar manner, but in this case it represents the multiplier. The answer is then expressed by the position of the upper jaw. For examples in negative multiplication the lower jaw may be used for the same purposes as in division.

Examples in square root are performed by maintaining proportionate movements or speed between the stop block and angle gage.

The equal distances between the graduations in the respective scales make the peculiar construction of this instrument well adapted for automatic machine motions. The various adjustments referred to for working different examples are designed for machine computation.

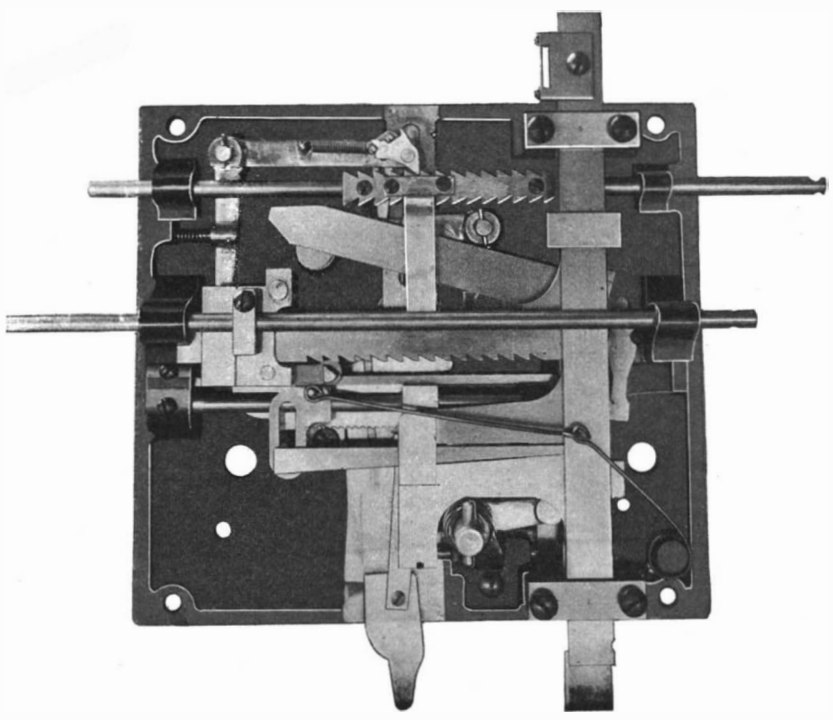
Computing Device for Type Justifiers.—The computing device for type justifiers is constructed to automatically perform simple examples in division and to give the quotient and remainder in order to determine the positions and motions necessary to locate the required sizes of space needed by the justifying machine.

This instrument necessarily performs more than the simple examples in division, as it is required to control and handle the other devices of the automatic mechanism, designating when they shall start and stop.

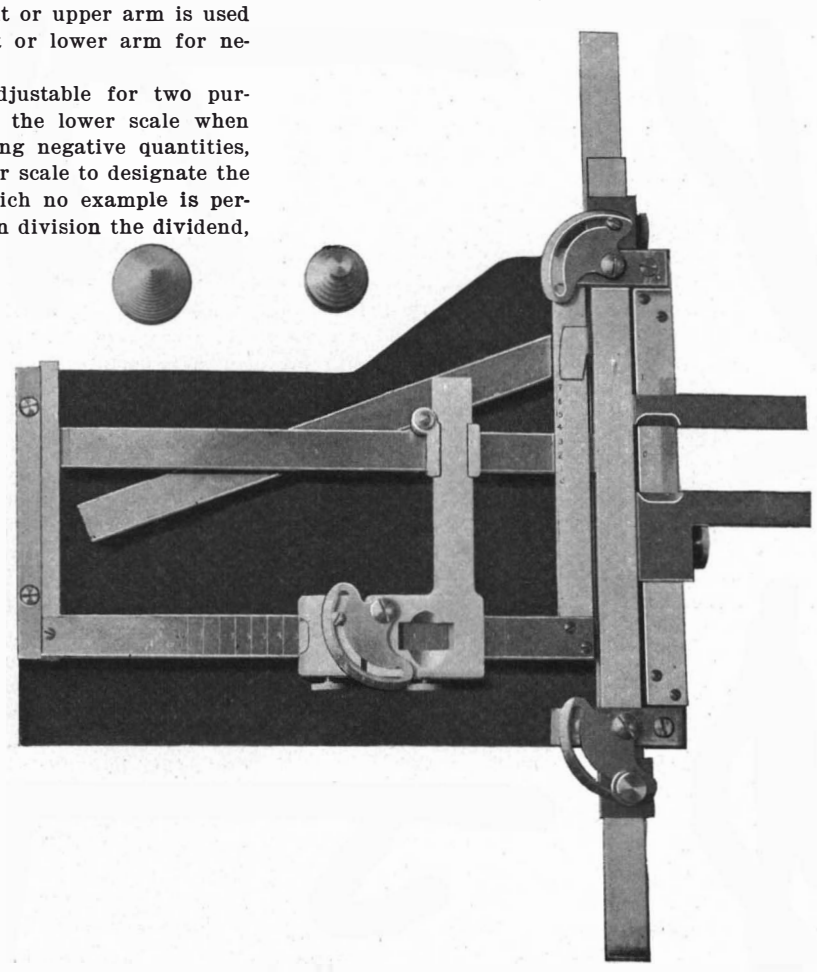
The line of type is given to the machine with metal separators between the words, making it necessary to subtract the amount of these separators from the total measurements.

The line of type including the separators is brought under the vertical guide of the measuring bar locating the stop block, which slides thereon, below the angle pivot, a distance equal to the line shortage, that is, the amount which the type line still remains short while it has all of the separators between the words. This is the distance to be divided by the number of separators.

The angle bar is lowered one step while each separator is inserted. This process tilts the computing angle on its pivot in accordance with the units of the divider, the stop block then moves leftward until it comes in contact with the computing bar. This gives the exact product in amounts representing units and fractions. The teeth on the under edge of the computing bar represents the units used, and in this case are made to represent the different sizes of spaces with which the machine is provided. If the pawl stops between two teeth this indicates that there is a fraction



COMPUTING DEVICE FOR TYPE JUSTIFIERS



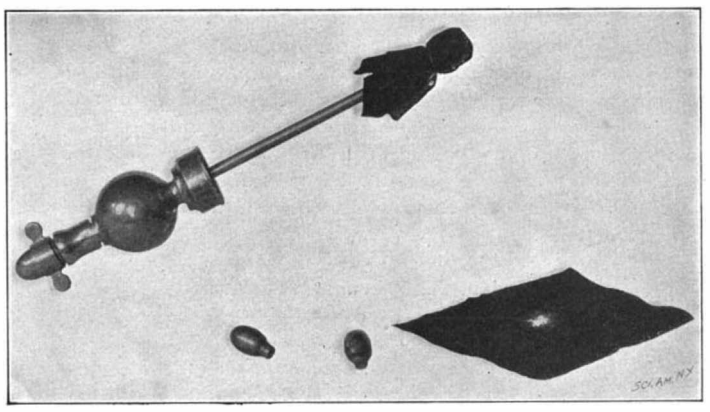
COMPUTING TRIANGLE.

or remainder. The machine then reverses the motion of the stop, forcing it backward till the pawl under it is intercepted by the tooth under the computing angle. This leaves a looseness between the stop block and the computing angle. The wedge under the measuring bar has teeth also representing units. The machine then proceeds to insert the wedge, thereby raising the measuring bar with the stop block until it is again tight, against the computing angle. In doing this the wedge moves rightward, one tooth for each unit, as far as it can go. When the parts are in this position the escapement rod and rack above the computing angle moves leftward until its projection strikes against the stop block, and when at this position it is engaged by its pawl. The parts are now in readiness to begin the operation of inserting the spaces. With the insertion of each space the wedge is moved leftward one tooth, and when it reaches its starting point it causes the escapement rack in this case to slip one tooth. The downwardly projecting arm of the escapement causes the dog underneath to be pushed out from the lower tooth while the escape dog is thrust between the upper teeth, thereby causing the rack to change its position. This changes the size of spaces in the machine, after which the process of inserting the next smaller spaces is continued until the line is finished.

SOLID CARBONIC ACID FROM "SPARKLETS."

BY PROF. R. W. WOOD, JOHNS HOPKINS UNIVERSITY.

It may be of interest to those engaged in the teaching of physics, whose laboratory equipment is limited, to know that the solidification of carbonic acid by the cold developed by its own expansion can be shown with the "sparklets" which are now sold everywhere for the aeration of beverages. The "sparklets" are small steel capsules which are filled with liquefied CO_2 and sell for a few cents each. The larger of the two sizes is the best for experimental purposes. It is a good plan to start with the capsule well cooled, which can be done by packing it in ice and salt. The top of one of the siphon bottles is removed, the "sparklet" inserted, and a small piece of black velvet held tightly over the end of the tube which ordinarily conveys the gas into the beverage. The velvet should form a little bag the size of a small marble over the end of the tube and must be held tightly around the tube, so that the escaping gas has to pass through the meshes of the cloth. It is a good plan to take a few turns with a string around the velvet where it surrounds the tube. On screwing down the cap, the gas escapes into the small velvet bag, and the great cold produced by the expansion is sufficient to freeze a portion of the solid particles collecting on the inner surface of the little bag. On removing the velvet we find a layer of snow-white solid CO_2 on its surface, and if a small drop of mercury be placed on it, it can be frozen in a few seconds. The experiment is absolutely without danger, and the small price at which the "sparklets" can be procured brings one of the classical low-temperature experiments within the reach of every teacher. The advantage in using black velvet is that the white solid shows off to good advantage on the dead black surface. The "nap" should be on the inside of the bag.



SOLID CARBONIC ACID FROM "SPARKLETS."

SOME DISASTROUS ACETYLENE GAS EXPLOSIONS.

An accident similar to the one recorded in the SCIENTIFIC AMERICAN for March 25, 1899, occurred February 6 at Fort Wayne, Ind., in a two-story house occupied by four persons. On the morning of the occurrence, the young man clerk visited the cellar to thaw out the water-pipes. He lighted a candle and crawled through a small opening which connected the cellar with the front part of the foundation. He did not notice the smell of gas, and nearly reached the water-pipe when there was an explosion which hurled him backward. He retained presence of mind enough to scramble back, and hurried upstairs to assist the other members of the house in getting out of the débris. The explosion completely wrecked the building. The entire front of the house was blown out, and it remained practically intact. The west wall was half destroyed, the explosion tearing away the section holding the weather-boarding apart from the studding and the plastering. The inside of the house was a total wreck. The floors of several of the rooms were pushed upward, and the fire was extinguished before it could get any headway. The child who was sleeping on the sofa directly over the seat of the explosion was not killed, but received a fractured skull. It is evident that there must have been an extensive accumulation of gas beneath the house which remained undetected by the occupants.

A somewhat similar explosion took place in the house of T. E. Gould at West Brookfield, Mass. The house was lighted by an acetylene gas plant installed in the cellar. Shortly before the explosion occurred the lights failed to burn, and Mr. Gould started down the cellar stairs, with a lighted lantern, to investigate the trouble. A slight explosion drove him back, and while he was going to the outside cellar door, with the intention of throwing it open to permit the escape of the gas, the disastrous explosion took place. Of the five persons in the house at the time, Mrs. Gould and a neighbor were instantly killed, Mr. Gould and a servant were so badly injured that they died within a week, and a sister of Mrs. Gould's, who was in one of the front rooms, escaped practically unharmed. The extent of the damage can be easily read in the illustrations. The rear of the house was entirely demolished. Not a square foot of plaster was left on any of the walls, not a pane of glass remained unbroken. Bits of wreckage were picked up over a quarter of a mile away. In adjacent houses windows were smashed, curtains torn down, pictures thrown from the walls and crockery broken. The entire town was shaken, and the noise of the explosion could be heard at a distance of five miles.

What caused the gas to escape is not known, but it is supposed that the safety pipe, which was small and inadequate for the purpose, became clogged, and the gas, generating faster than it was consumed, broke the water seal of the gasometer and escaped into the cellar. It must then have been ignited by coming into contact with the fire in the steam heater which was also in the cellar.

A HOUSE AT FORT WAYNE, IND., PARTIALLY DESTROYED BY AN ACETYLENE GAS EXPLOSION.

A RESIDENCE IN WEST BROOKFIELD, MASS., ALMOST DEMOLISHED BY A GAS EXPLOSION.

Science and Yellow Journalism.

When newspapers scream at the crowd misrepresenting accounts of scientific matters so completely beyond the common comprehension that hardly a dozen men in a nation can understand anything whatever of the matter, it is easy to foresee that the reputation of men, of institutions, and even of a country, may be injured. Do American universities, came the question from abroad, sanction the publication of the results of the most recondite researches of their professors in the Sunday newspapers? If not, how did these papers secure the long earmarked quotations? An experiment in parthenogenesis is quoted as it is described by the "American" reporter as "the jelly-fish did not jell," and Europe laughed. We have been at a great deal of pains to ascertain the facts as to responsibility for the newspaper outgivings in the special case alluded to, and we find beyond all question that the principal man mentioned as the revealer of all mystery not only had nothing whatever to do with this newspaper notoriety, but that it misrepresented him as completely as it was loathsome to him. No blame whatever can attach to him. Students acting as reporters, and for it dismissed from the institutions, and others who were careless, or worse than careless, were accountable for a quickly recognizable injury to friendships, to institutional and national reputation, and to science itself. The lessons are plain. All who believe, as we do, that the person principally quoted is utterly innocent should hasten to compensate him for the injury done him by the criminal folly of others; and assure him of the honor in which he is held by the discriminating, and for the credit that will finally be recognized as due to American science through the work of a most worthy investigator. Next in importance is the proper punishment of the willful blunderers. But most of all should every scientific man guard against any such possible happenings in the future.—American Medicine.

Chinese Typesetting.

The Chinese language is derived from 214 root-words, which expand into the 4,000 or 5,000 words of daily use, and the thirty-odd thousand of the dictionary. It requires 11,000 spaces to hold a font of Chinese type. The large cases, or false partitions, are ranged about the room and divided into spaces for each individual type, each a word complete in itself. A Chinese printer, it is estimated, can arrange 4,000 characters a day. The work has been carefully systematized, and the characters are arranged according to their formation. A simple character designates its group, and the elaboration of form is the elaboration of its meaning, as our terminations and prefixes elaborate the root. A division is devoted to the simple character that stands for "wood," and all of its amplifications. In this space or column are to be found "box," "bed," "plum tree," and so on, through a long list of objects pertaining to, or made of, wood. Should an unusual word be needed type is cut and delicately patched to make the required character. Comparing our combinations of twenty-six letters and ten figures, besides common symbols, an idea of the labor of a Chinese compositor can be formed.

Painters' aprons, soaked in turpentine twenty-four hours before washing, lose all oil paint spots.

Correspondence.

A Home-Made Gramophone.

To the Editor of the Scientific American:

I sent a drawing, clipped from your paper last summer, of a home-made gramophone, to my brother in Warrensburg State Normal School, Warrensburg, Mo., and he has just completed a machine in the manual training room which he says is a perfect success. It is on exhibition at the Normal (1,000 students). Many thanks to the Scientific American.

J. A. Thomas.

Oklahoma City, Okla., February 18, 1902.

Electrocuting a Snake.

To the Editor of the Scientific American:

Mr. E. W. Kelly's story of the bird tragedy in your issue of the 8th instant recalls an incident which I witnessed a few years ago at Council Bluffs, Iowa.

While waiting for a bridge car I was attracted by a commotion among the employés at the barns. Upon investigating matters I learned that an ordinary garter snake about 20 inches long had been discovered in one of the repair pits, and the men proposed to electrocute it, the snake having been stunned sufficiently by a blow to enable them to get it up on the track. One end of a loose wire was connected with the trolley wire overhead, the lower end being coiled about a long stick for convenience of handling.

The snake was then laid out with its tail held firmly on the track, its body being so arranged as to quickly demonstrate whether or no snakes are good conductors. That particular snake certainly was not, as it was impossible to produce the slightest quiver in any part of its body, no matter how the contact was made, whether externally or by jamming the wire into its mouth.

The result was as surprising as it was disappointing, so much so that the men believed the "power was off." That was quickly tested, however, and the fusing of a foot or two of the wire the instant it touched the rail showed very conclusively that the 550-volt current was all there, ready for the proper conductor.

It is sufficient to state the snake was forthwith dispatched in the old-fashioned way.

William T. Bonner.

12 West 31st Street, New York.

Merchant Marine Subsidies.

To the Editor of the Scientific American:

Your issue of March 8 contained an article entitled "How Various Countries Subsidize Their Mercantile Marine," and I beg leave to call your attention to a serious error contained therein. The assertion is made that "German lines are the most heavily state-subsidized steamship lines in the world, and but for this government assistance it is very doubtful if Germany would have attained its present position in the mercantile marine among the maritime nations of the world. Certainly no fast steamships, such as the 'Deutschland,' 'Kronprinz Wilhelm,' and the 'Kaiser Wilhelm der Grosse,' would have come into existence." I wish to call your attention to the fact that the Hamburg-American Line, which was founded in 1847, has never received a cent of subsidy for its transatlantic service, and has grown and prospered without the aid of any government or state whatsoever.

About two years ago the Hamburg-American Line was admitted to a share of the subsidy hitherto paid to the North German Lloyd Steamship Company for its East Asiatic service, and receives this subsidy only for two steamers, the "Hamburg" and "Kiautschou," running in connection with similar steamers of the North German Lloyd from Hamburg and Bremen to East Asia.

The construction of our steamer "Deutschland" has, therefore, nothing to do with subsidy whatsoever.

Our line has a total tonnage of 668,000 tons, and of this total tonnage only 21,511 tons, representing the two steamers "Hamburg" and "Kiautschou," are subsidized, while, as I stated before, the rest have been constructed without any state aid whatsoever.

Emil L. Boas,
General Manager Hamburg-American Line.

New York, March 8, 1902.

Strength of Torpedo-Boat Destroyers.

To the Editor of the Scientific American:

In your issue of February 8 we notice an article on "The Frailty of Torpedo-Boat Destroyers." We are quite aware that many accidents have occurred of late with destroyers, but that only proves that certain destroyers are weak; it does not prove that destroyers cannot be built of ample strength without sacrificing speed, or that the scantlings are not sufficient if the workmanship and details of construction are correct.

We have built eight destroyers for the Japanese government, six of which long since steamed safely out to Japan, and have been engaged during the Eastern crisis in navigating between Japan and China, and in no case, we are officially informed, has there been any sign of weakness, except such as may be purely local; and during all these journeys it is reasonable to assume that very bad weather was encountered; in fact, we know that was so at times.

There is one point that seems not to be sufficiently appreciated, and that is that the safety of lightly-constructed vessels, such as destroyers, is dependent to a very large extent upon elasticity when encountering rough weather, and this elasticity must be as uniform throughout the structure as it is possible to make it, otherwise the bending which takes place will be concentrated at certain parts, and the metal of those parts, after a certain time, gets fatigued and ultimately gives way. To study how to secure uniformity of elasticity throughout the structure in vessels of the destroyer class we are sure deserves more attention on the part of constructors than has hitherto been devoted to it.

Yarrow & Co., Ltd.,
A. F. Y.

Poplar, London, E., February 22, 1902.

Insect-Proof Timber.

To the Editor of the Scientific American:

Your issue of November 17, 1901, contains an illustration of a cross-section of a pile riddled by *Teredo navalis* (called in this country cobra), together with letterpress description of this pest and the various devices for guarding against it, such as sheathing piles with Muntz metal, dressing with chemical compositions, etc., but you do not mention any timber naturally proof against cobra and other wood-eating worms and insects. A large area of this country—always sandy tracts of almost barren soil—produces a variety of pine locally known as cypress pine. *No insect or borer on earth* will touch this timber. It is largely used for wharf and bridge piles and other under-water structures. Some of the wharves in this port have been built forty years. All the beacons, leading lights and marks in the ports and coast channels are carried on piles of cypress. Floating plants of such a type as punts, barges, lighters, etc., are sheathed to waterline with cypress one inch thick, it being far cheaper than Muntz metal and quite as effective.

Sawn up and worked into furniture such as wardrobes, chests of drawers, bookcases, cabinets, etc., it is not only a very handsome material, owing to its fine-figured grain in shade of light and dark brown—very like walnut—but there again its insect-proof qualities are of great value. Books, papers, linen or anything of that sort kept in it are never touched by silver fish or cockroaches, which are a common pest in this country. The wood has a very strong scent, highly agreeable to human olfactory nerves, but evidently disagreeable, perhaps poisonous, to insect life both on land and water; even our all-devouring white ants won't touch it.

It grows straight as a rule, not very tall; piles from 40 to 50 feet long, 2 feet diameter at butt end tapering off to 1 foot or less at top end are about as long as they usually grow, though I have seen some over 70 feet. On the outer surface is a thin skin of white sapwood ½ inch to ¾ inch thick. This sapwood has little or no protective power; in piles it is usually eaten off by the cobra (*teredo*) within a few months, but they always stop short at the dark wood. I do not write this with any idea of suggesting export for sale, but merely to let you know there is such a timber growing. You might like to get some seed sent over to plant in your own go-ahead country; it does best on sandy barrens.

Edward Armitage.

Kent Street, Maryborough, Queensland, Australia.

Sven Hedin's Return from Thibet.

Sven Hedin, who started out some time ago to explore Central Asia, has returned to Cashmere, after stirring adventures in Thibet. At present no definite information can be obtained; for Hedin merely sent a telegraphic despatch to the King of Sweden giving a bare outline of his adventures. Like many another explorer before him, he could not resist the temptation of trying to enter the forbidden city of Lhasa. Disguised as a pilgrim, he succeeded in approaching within a few miles of his goal. The sudden discovery that a stranger was near threw the town into consternation. Hedin was at once captured and imprisoned. It seems that his captors were more merciful than they were to Landor; for he was in no way injured. By the express command of the Dallai Lama, Hedin was well treated.

Not content with the failure of his first atempt, Hedin tried a second time to enter the town. Without any warning 500 soldiers attacked him, and destroyed a large part of his caravan. His ardor was then so far cooled that he determined to return, after rescuing his notebooks and the data which he had collected.

Dr. Albert R. Leeds, for thirty-one years professor of chemistry at Stevens Institute, in Hoboken, died at his home, in Germantown, Pa., recently from liver disease. He was about fifty-five years old.

Chamonix Electric Line.

The Bulletin of the Société des Ingenieurs Civils contains an account of the new Fayet-St. Gervais-Chamonix electric line, which is now in operation. It has been installed under the direction of Messrs. Baudry and Maréchal. This line is one of the most interesting applications of electric traction in Europe. It contains some heavy grades, one of which is 9 per cent over 6,000 feet distance and another of 8 per cent for 4,500 feet. The traction is carried out by simple adherence, using cars carrying electric motors. The cars are equipped so as to be operated independently if desired, but in general several cars are coupled together to form a train. A great many difficulties were encountered in the construction and successful operation of the road, but it may be said that these have all been overcome. The third-rail contact system is used to take the current, and besides, on the steep grades, there is a fourth rail laid along the center of the track which serves for the grip-brake. The vehicles have a central passage and contain 32 or 36 places according to class. Each ascending train comprises four passenger cars and a front car which contains the baggage, and the engineer's cab. Each car has two motors which drive the axles by a bevel gearing mechanism. Another feature of the system is that each car is equipped with controlling apparatus which allows it to be operated as an independent unit, but when coupled together all the controlling devices are capable of being operated from the engineer's cab in front. Each car has a set of brake shoes as well as the jaw-brake which grips the rail. The brakes can be worked either by hand on each car or simultaneously from the engineer's cab by compressed air. A complete train of five cars with its ten motors can make an average speed of 7 or 8 miles an hour when going up a 9 per cent grade, with an absorption of energy represented by 800 amperes at 550 volts. The total length of the line is 11.4 miles and the journey, stops included, takes about an hour. In the descent, the speed is limited to 6 miles an hour on the grades. The line is fed by two central stations, one situated beside the track and near the hamlet of Chatelard, and the other at Chavants. Continuous current is used in the two stations. Both are hydraulic plants, and each has a derivation canal from the Arve, a rapid mountain stream. Each station has four direct-connected dynamos and turbine sets, of 325 horse power each (one of which is used as a reserve), and two smaller groups for local use. All the dynamos are of the Gramme type and are connected to the turbine by elastic coupling. At the Chatelard station the fall is 114 feet and at Chavants it is 282 feet.

The Scientific American Supplement Catalogue.

A new edition of the Catalogue of Papers in the Scientific American Supplement has been in preparation for nearly a year and has now just been issued. Those who are familiar with the old catalogue will welcome the new one as embodying all the good features of the earlier editions, but bringing it absolutely up to date. The value of the catalogue is, of course, enhanced by the fact that all the papers listed are in print and can be supplied at once. The Supplement occupies a unique position in American technical literature, as it carries no advertisements. Every page is filled with valuable matter of interest, and much of the information never filters into books at all.

In the preparation of the new catalogue the same general lines have been adopted as in the old catalogue. Every entry was supervised by a member of the staff, and over 12,000 papers are now listed. The new catalogue fills sixty pages. While, of course, the catalogue is issued by the publishers primarily to call attention to the individual papers in the Supplement with a view to possible sale, it is, after all, a valuable book of reference, and most libraries have it bound. It is mailed to any address on request.

The Current Supplement.

Among the most important articles published in the current Supplement, No. 1368, may be mentioned an illustrated description by Frederic Moore of "Gold Mining in North Carolina;" an exhaustive discussion of "Range-Finders" by Prof. George Forbes, and an essay on "Ignition Devices of Gas and Petrol Motors" by S. R. Bottone. Other articles of interest are entitled "Early Forms of Electric Motors," "Science in the Theater," and "German Drilling Machines." The Consular Notes and like brief information will be found in their usual places.

In our description of the Lorillard houseboat, given in the recent Automobile and Outing number of the Scientific American, credit for the design was inadvertently given to Messrs Tams, Lemoine & Crane, of this city, to whose courtesy we were indebted for the plan, etc., from which our description was drawn up. We are now informed by this firm that Mr. Lorillard employed Mr. M. Hubbe, of New York city, to put his ideas into shape and that he should rightly be considered the designer.

THE ENGINES OF THE NEW YORK EDISON POWER STATION.

There has lately been opened another of those great electrical generating stations which are becoming such a notable feature among the power plants in this city. It has been constructed by the New York Edison Company, and in its general arrangement it follows broadly the plan adopted in the Metropolitan Street Railway Company's power house and that of the Manhattan Railway Company; that is to say, the power house consists of one great rectangular building, with a division wall running longitudinally through its center and dividing it into a boiler house and engine room. The rated capacity of this plant when it is completed will be 85,000 horse power, and its maximum capacity 128,000 horse power. The power house lies between 38th and 39th Streets, First Avenue and the East River. It extends 197½ feet between the two streets named, and has a length of 272½ feet. The division wall is so placed that it provides a boiler house 79½ feet in width, and an engine house 118 feet in width. In the boiler house are 56 Babcock & Wilcox boilers of 650 horse power each, which are carried upon two separate floors. The working pressure is 225 pounds to the square inch, and all boilers are equipped with the Roney mechanical stoker, the hoppers of which are fed direct by means of chutes from a huge coal storage bin, which extends the whole length of the boiler house, and is located immediately below the roof of the building. This bin has a capacity of 10,000 tons of coal, and it is loaded automatically by means of conveyors which bring the coal direct from barges at the company's pier on the East River.

A striking feature of this plant is the four huge steel-plate chimneys. These stacks are 17 feet in inside diameter and measure 200 feet in height above the grate bars. They are built of steel with an inner lining of brick, and the weight of each chimney complete is about 500 tons. The thickness of the steel shell varies from ⅝ of an inch in the lower portion of the chimney to ½ inch at its middle section, and ⅜ of an inch in the upper third. Firebrick is used for lining the lower third, and red brick for lining the upper two-thirds of the chimney.

In the engine room, when the whole plant is completed, there will be no less than sixteen Westinghouse-Corliss engines of 8,000 indicated horse power. These will be arranged in two rows, extending the full length of the building, with an open passageway between them. With 175 pounds steam pressure, and at 75 revolutions per minute, the most economical capacity will be about 5,500 indicated horse power; but the maximum capacity will be 8,000 horse power. The engines are of the compound, vertical, three-cylinder type, working upon three cranks, with the high-pressure in the center and the two low-pressures on the outside. They are direct-connected to the generators, the latter being placed toward the inside of the building and adjoining the central passageway, which extends from east to west through the building. The crank-shaft is built up in three forged sections, with a 10-inch axial hole which is reduced to 8 inches where the shaft enters the cast-steel crank-cheeks. The cranks are set at angles of 101, 133 and 126 degrees, with the idea of securing as perfect a turning moment on the shaft as possible. The stroke of the engines is 5 feet, and at 75 revolutions per minute the piston speed will be 750 feet per minute. The steam is led to the high-pressure cylinder of 43½ inches diameter through a 14-inch throttle valve. It passes thence to a reheating receiver, which is about 4¼ times the displacement of the high-pressure cylinder and 7-10 the combined displacement of the two low-pressure cylinders. From the low-pressure cylinders, which are 75½ inches in diameter, the steam is led by 26-inch mains to the condensers, of which there is one to each engine. They are of the surface type, and in each of them are 3,752 ¾-inch brass tubes, 12 feet 9⅛ inches in length, which give 9,200 square feet of cooling surface.

A remarkable feature about these engines is that they are the first large engines built in this country to be equipped with poppet valves, which were adopted because of their suitability to the use of superheated steam, the poppet valve lifting from its seat without any rubbing friction and being, therefore, but little exposed to the difficulties of lubrication which ordinarily occur with the use of superheated steam. The low-pressure cylinders are fitted with double-ported valves of the Corliss type. The steam and exhaust valves are driven by separate eccentrics, which are mounted upon a lay shaft which is carried in bearings attached to the first gallery. This shaft is driven from the main shaft by spiral gears, the vertical shaft of this transmitting mechanism being carried upon a ball-bearing and serving to operate the governor from its upper end.

The speed of the engine can be varied any time by mechanical adjustment at the governor, made while the engine is in motion. There is also an electrically-operated mechanism by which the speed can be controlled from the switchboard, for synchronizing the alternators that are operated in parallel. We are indebted for our information to Westinghouse, Church, Kerr & Company, by whom these fine engines were installed.

Engineering Notes.

An interesting experiment in connection with submarine fog-signaling has been carried out at Egg Rock Lynn, England. A bell was hung 50 feet below a buoy, moored in 15 fathoms of water, and was struck by electricity from the Egg Rock Light Station, where a power house is established. By means of such submarine signaling it is stated that a person placing an ear against a rod held in contact with the hull of a vessel, is able to hear the bell from three to five miles away; in fact, it is believed that the ringing of the bell can be heard at a distance of ten or twelve miles.

The baggage-handling methods of the European railroads have long been the butt of ridicule, but there are a great many features of the system now in use at the new Quai d'Orsay station of the Orleans railroad in Paris which are ahead of anything in the United States. Trunks and packages are available almost instantly on the arrival of trains. For the purpose of handling the pieces quickly there are ten inclined chutes in combination with moving platforms which carry the baggage directly from the train to the delivery room. The system is capable of handling almost everything in the shape of baggage which is ordinarily encountered, but for large pieces there are also several elevators available.

The shipbuilding industry of Great Britain has not enjoyed such a lease of prosperity as it is experiencing at present for several years past. The yards of the Clyde, Tyne, and other centers are so full of contracts that work is being maintained at the highest pressure to cope with the orders. Several large liners for the various leading steamship companies of the country are on the stocks, and the new orders are accumulating so rapidly that several new shipyards are to be constructed in various parts of the country to enable the work to be executed expeditiously. On the Clyde four new liners for the Peninsular and Oriental Steamship Company are being laid down. The White Star, Cunard, American and several foreign lines have commissioned new vessels, while the demand for freighters is almost unprecedented. At the close of the last quarter 477 vessels, representing 1,500,000 tons, were under construction, an increase of 100,000 tons upon the previous quarter, and 200,000 tons increase upon the corresponding quarter of last year.

In Great Britain a National Industrial Association is being established for the promotion of British trade and commerce and the recognition of arbitration in trade disputes. The idea is being attended with considerable success in every part of the United Kingdom. As may be easily supposed, the organization of such a huge undertaking entails an immense amount of work, and will yet take some little time to get into working order. The objects of the association regarding trade disputes where strikes or "lockouts" threaten or exist will be to organize and focus public opinion, so that the parties will be compelled to accept an arbitration award. The association will equally represent masters and men, and will appoint impartial arbitrators with authority to investigate disputes and to publish reports, laying the blame on the right shoulders. The arbitrators may be called in by either party, and if one side elects to give evidence the other can abstain at the peril of losing its case. If neither party desires arbitration the arbitrators can nevertheless secure information and publish a report for the information of the public. By this means an aroused and instructed public opinion will enforce submission.

W. F. Singer, of New York, is the inventor of an automatic pump for automobile use in which the vertical motion of the body of the carriage is utilized to actuate a series of pumps for supplying water to the boiler and air to the gasoline tank. The pistons of the pump are pivotally connected to a pivotally attached vertical post, forming a toggle joint of which the point of attachment to the vertical post is the elbow. The pumps are so spaced apart that the pistons of each are at the end of their respective strokes when the toggle-joint is fully extended, so that a movement of the vehicle body either up or down from its normal position drives the pumps. By pivoting the vertical post to its attachment danger to the pumps from a sidewise lurch of the vehicle is obviated and the action of the pumps is equalized.

An idea of the inroads, present and prospective, which the American automobile is making and will make in foreign territory may be had from the fact that during the present year an exhibition composed entirely of motor vehicles designed and built in the United States will be held in the Crystal Palace, London.

Electrical Notes.

In spite of its enormous size the Cathedral of Notre Dame in Paris has hitherto been simply lighted by wax candles, as gas, it was thought, would damage the walls and valuable paintings. Now we understand that it is about to be electrically lit. The cost of installing the electric light is estimated at $90,000.

From the latest reports from Nyassaland it appears that British Central Africa is in a fair way to become an industrial colony soon. The most recent move in the development of the country is a concession which has been granted by the imperial government for the construction of a line of railway from Chiromo to Blantyre, connecting the center of the coffee plantations with the coast by way of the Shire and Zambesi rivers, says the English Electrical Engineer. Operations are expected to begin toward the end of the year, and will probably last for two years or so. Meanwhile, it is stated, experiments are being conducted with a line on the monorail principle, and it is also intended to establish a system of motor trolleys and traction engines for transport work in the protectorate.

In a recent article the Echo des Mines et de la Metallurgie says that three electric furnaces of 500 horse power each have been erected in the valley of Camonica, northern Italy, for the manufacture of pig iron under the Stassano patent. In these furnaces the electrodes are placed at the bottom of the boshes. In the operation of the furnaces the ore is first pulverized; a sample is then analyzed for the purpose of calculating the amount of carbon required to perform the reduction, as well as the necessary amount of fluxes. The quantities of carbon, lime or silica thus determined are pulverized and mixed with the ore. The material is then briquetted, after adding five to ten per cent coal tar, and is ready for charging into the furnace. By means of the heat developed around the electric arc, the iron ore is decomposed, the oxygen uniting with the carbon to form CO_2. The latter gas ascends into the upper part of the furnace, where it effects a partial reduction of the ore. To obtain a ton (metric) of metal, 3,000 horse power hours are said to be required, costing about 18 francs.

A curious solution of the telephone relay problem is offered in a patent granted October 15 to one Bela Gati, of Temesvar, Austria-Hungary, says the Electrical World. The inventor connects one winding of each of two repeating coils by a circuit containing a generator and an arc lamp, which may be either in series or in parallel with the windings of the coils. The theory is that the weak telephone currents traversing the transmitting circuit, act by induction upon the lamp circuit and cause corresponding increase and decrease of current therein, which in turn will cause the carbons of the lamp to vary in their separation, thereby decreasing the resistance of the lamp circuit and increasing the supply of current from the lamp supply circuit. This amplified current will correspondingly reinforce an induction coil in circuit and send out to the receiving telephone much stronger impulses than were created by the voice in the speaking circuit. This is certainly a strikingly bold attempt at the telephonic relay problem, but it would require a delicacy in carbon feeding mechanism difficult to attain, to say the least, while in practice the arc lamp circuit, through its normal fluctuation, would have something to say for itself with rather a disturbing effect on telephone currents.

The opening of the Paris underground railroad—or something else—seems to have had a disastrous effect on the other transportation enterprises of that city. Until very lately there was little street railroad in Paris, but an omnibus system, worked by a single company, which, with transfers, covered the whole city, and was perhaps the most complete and efficient omnibus system the world has ever seen. On the eve of the 1900 World's Fair not only was the Metropolitan (underground) railroad built, but a considerable extension of street car lines was made, says the Railroad Gazette. It seems that a great deal of water was injected into the stock of most of the new enterprises, and naturally they have made short work of a large part of the omnibus traffic, which is hardly a twentieth century institution. The result, as interpreted on the Paris stock exchange, is seen by the quotations for shares in October this year and last. Omnibus Company shares have fallen from 1,660 francs to 780; Thomson-Houston Company from 1,290 to 814; other tramway companies from 730 to 500, from 355 to 250, from 474 to 147, and from 590 to 345. On the other hand Metropolitan (underground) shares have risen from 533 to 574, and Parisian Electric from 252 to 261. Doubtless several of the street railroad companies whose shares have fallen so greatly are yielding good interest on the capital actually invested in them, and Omnibus Company shares, worth 1,660 last year and 780 this, are 500-franc shares; but this does not mitigate the fall to those who bought last year.

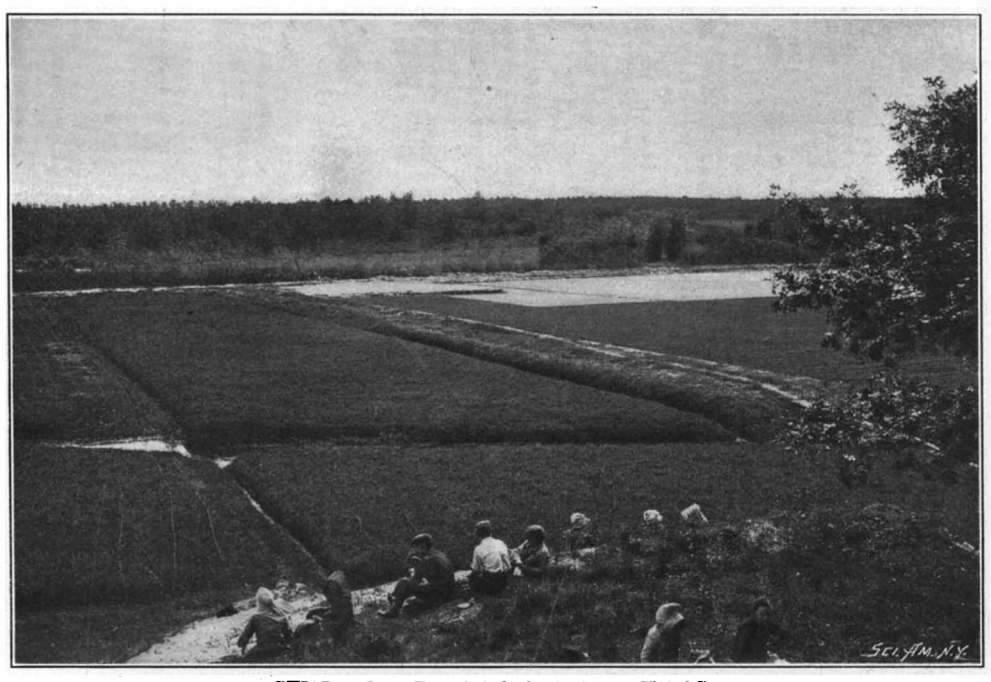
THE CRANBERRY INDUSTRY.

The cranberry growers of the United States have to their credit this year a crop of 1,000,000 bushels. Of the varied industries that have shown unusual results, there are none with a more notable record, for the crop of 1900 was 569,000 bushels. These facts mean that the owners of the cranberry bogs will have

FIRST YEAR'S GROWTH OF THE BUSHES ON A CRANBERRY BOG.

received, when the crop is fully marketed, nearly $1,700,000.

Cranberry raising is an industry which, despite the popularity of the fruit, has commanded small attention from others than those directly interested. Capital is an absolute necessity to engage in it successfully, as a productive bog costs from $300 to $500 an acre to bring to a state of profitable bearing.



GENERAL VIEW OF A CRANBERRY BOG.

HOW THE LABOR OF GATHERING THE BERRIES IS APPORTIONED.

Originally a wild growth, the berry only reaches a state of perfection when cultivated. It is found in its natural state in the northern portions of the United States adjacent to the Canadian border, in the salt marshes of several coast States, in the glades of the Alleghenies, and as far south as Virginia and North Carolina. The wild berry is smaller than its cultivated cousin, and, in apposition to the strawberry, is less delicate in flavor. Moreover, the yield is much less in proportion, and the vines cease bearing after awhile, something that is never true of the vines of a cultivated bog.

The preparation of a cranberry bog is a task requiring much patience and care. Sometimes a marsh is selected, but the bottoms of abandoned mill ponds are most desirable sites. The vines grow best in silicious soil free from any mixture of clay. The presence of silex or silicon is necessary to productiveness and the finest fruit. For this reason great care is exercised not to attempt cultivation in drift formation, as in only alluvial formation can success be achieved. When it is considered that the cultivation of wild cranberries was not attempted until early in the last century, and, furthermore, that it became an embryo industry less than fifty years ago, the results attained are notable.

Once the site of the bog is selected, the soil is prepared for the reception of the cuttings or uprights. The best soil is found to be clean, sharp sand, overlaid by peat. The ground is then marked out in rows fourteen inches apart. The uprights are pressed into the ground with a spade-like tool, placed on the vine about one-quarter the distance from the root to the top, in close proximity to the soil below the sand. Sometimes the vines are chopped into pieces about an inch long. These pieces are sowed like oats on an evenly prepared surface, and then harrowed in. The hardiness of the cranberry vine or bush is shown by the radical success of this primitive mode of planting, for the uprights take root almost immediately. Soon after planting, the uprights send out "runners," which in turn take root. In three years' time the vine comes into bearing, and in five years the bog, if it has received proper attention, gives a liberal yield of fruit.

Cranberry bogs require a plentiful supply of water, and to provide this the grower follows a system of irrigation. Ditches are excavated through the bogs, and from these, 100 to 300 feet apart, laterals or cross ditches are constructed, in which the water runs from six to twelve inches deep. The flow of water is regulated by a gate, and the different sections of the bog are separated by dikes. The dikes are essential features of the bog, because by their aid the flooding process is accomplished. Frost is the cranberry's enemy, and, singularly, water is the only protection for the berries. Thus, when the grower believes a frosty

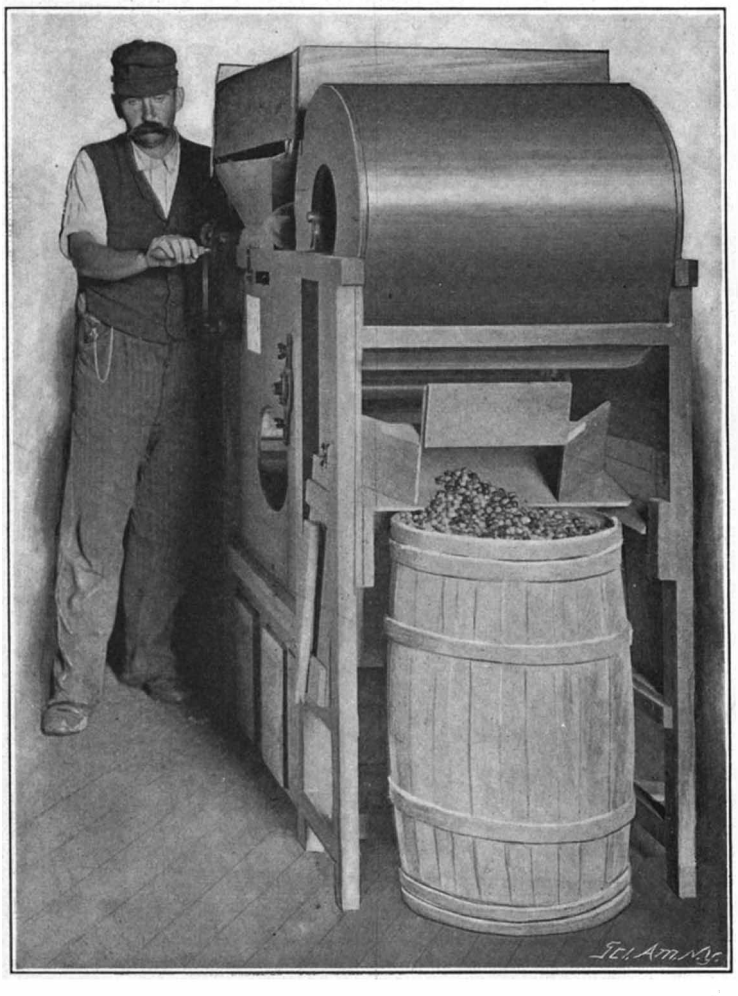
PICKING CRANBERRIES.

night at hand, he floods those sections of the bog where the fruit remains ungathered, letting the water in until its level is 18 to 24 inches over the tops of the vines. With the coming of the sun the water is drained off, and in a short time the ground is dry enough for the pickers to work. After the crop is gathered, in fact from the last of October to the first of March, the bog remains in a flooded state.

The cranberry bog blossoms in June, and it is its appearance at this stage of growth that gives the berry its name. Just before expanding into perfect flower the stem, calyx, and petals resemble the neck, head, and bill of a crane. Hence the name "cranberry," which usage has shortened to "cranberry."

In September the cranberry harvest begins, although October may more properly be called the harvest month. When the section of the bog where the picking is to start is selected, it is divided into rows, the boundary lines being marked by stout twine, running the entire length of the section. These rows vary in width from two to three feet. A row is assigned to a picker, who must strip the vines therein thoroughly before he is allowed to change to another row.

The method of removing the berries from the vines is simple and expeditious. The picker places his fingers, slightly spread apart, beneath the vine, or bush, close to the ground. A quick upward movement, and his hands have stripped the vine of its fruit. The



WINNOWING CRANBERRIES PREPARATORY TO PACKING FOR MARKET.

berries are dropped into a pan by the picker's side. When the pan becomes full it is emptied into a pail holding one-third of a bushel, the contents of these pails, in turn, being placed in crates. The crates are taken to the storehouse, where the berries are put through a winnowing machine, which removes the dirt and leaves gathered during the harvesting. Following this they are crated or barreled, and made ready to ship to market.

The pickers average from seven to twenty pails a day, the number being regulated by individual skill. The average price paid is twelve cents a pail. A picker may be of almost any age, and it is no unusual sight to see whole families at work in the bogs during the comparatively short season of picking Unlike the hop and grape gatherers, the pickers are generally farmer folk of the neighborhood, who take this method of adding to the year's income.

Coincident with the opening of the picking season, early in September, the new crop of berries begins to appear in the market. Few people, dealers say, are able to distinguish the old from the new. The newcomers are worth about five dollars a barrel to the producer, but by the time they have reached the consumer the price is likely to be ten cents a quart, although, if the supply is very plenty, the price is occasionally not more than five cents a quart.

These pioneer berries come from the greatest of cranberry-producing sections, Cape Cod. It is here that cranberry cultivation was inaugurated at the beginning of the last century.

A FLOODED CRANBERRY MARSH.

Cape Cod furnishes a large proportion of the best berries, and about two-thirds the total crop of New England. Next in volume of productiveness comes New Jersey, whose product this year is placed at 300,000 bushels. Part of the Jersey crop is made up of wild cranberries. These are sometimes picked before they have begun to color, then spread on the ground, and exposed to the sun for six weeks; it is claimed that in this way a deeper color is secured.

Following New Jersey come New York State berries, most of which are grown on Long Island. These, on the whole, are particularly good berries, large in size, and for that reason attractive. The cranberry is the one fruit whose quality is held second to its appearance.

There are cranberry bogs in Wisconsin, Michigan, Minnesota, and northern Ohio, and the times of harvesting and marketing are about the same as in the East. The western berry seldom finds its way east, for the home demand is as great as the supply. For this reason the eastern berry often finds its way well toward, and sometimes beyond the Mississippi. Generally it is of better quality, for the proportion of western berries gathered from wild vines is large.

Every year small consignments of cranberries are shipped to Europe, and statistics show a slight but steady increase of exportations. It is only natural that this increase should occur, because the American cranberry is ineffably superior to the European. England receives most of its cranberries from Norway and Sweden, but they are not nearly so good as the American product. Perhaps poor quality has caused the cranberry to lack in popularity abroad. Certain it is that nowhere is this berry as popular as in the United States, where a larger quantity is consumed than elsewhere.

THREE-PHASE 10,000-VOLT RAILWAY AT GROSS-LICHTERFELDE.

BY FRANK C. PERKINS.

The electric locomotive used on the experimental Gross-Lichterfelde high-potential electric railway was designed and constructed by Siemens & Halske, of Berlin. The three-phase current locomotive is seen in the accompanying illustration. The door at the side bears the warning, "Danger. High-Tension Current, 10,000 volts." The locomotive is constructed of steel and mounted on heavy trucks. The brakes are operated by hand as well as compressed air. The air-pressure is secured by an electrically-operated compressor.

The main driving motors of this locomotive are of the asynchronous three-phase type and operate at a potential of 750 volts. The capacity of the motors is from 60 to 240 horse power at normal and maximum load. The speed of the locomotive is 60 kilometers per hour, the ratio of gearing being 1:3.15. If the line were long enough and the track of the right construction, it is stated that the locomotive could easily attain a speed of 125 kilometers per hour. The voltage required at this speed would be 2,000 volts at the terminals of the motors. The controller in the cab regulates the speed by arranging the motor winding in "mesh connection" for maximum pull; and for normal running at high speed, the voltage when connected in "mesh" would be 1,150 volts.

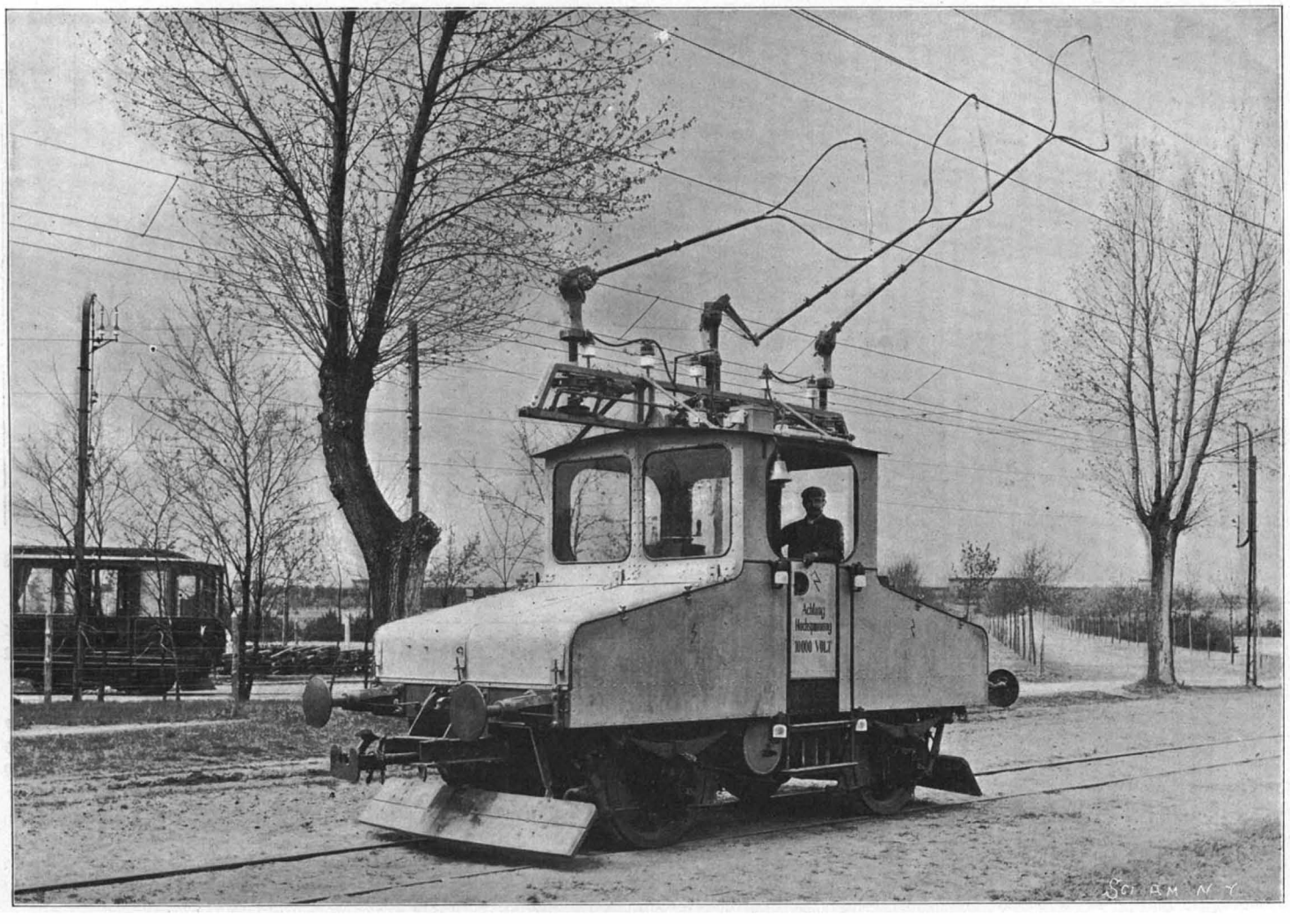
The locomotive has a total length of frame of 4 meters and a width of frame of 2.2 meters, the gage of track being 1.435 meters. The total weight of the outfit is 32,000 pounds. The distance between the axles is 2.8 meters, the diameter of the wheels is just one meter.

The line at Gross-Lichterfelde was built by the firm of Siemens & Halske for the purpose of studying the best means of applying three-phase current of high potential to traction purposes, and the results have been extremely interesting. Many difficult problems arose which have each in its turn been solved. The speeds attained are unfortunately limited by the shortness of the line.

Magnetic blowouts are used for the contacts of the controllers, and the resistance switches are operated in the transformer chamber from the controller by means of chains and chain wheels. The rheostats are mounted underneath the locomotive floor, and as the potential which enters the locomotive from the trolley wires is of 10,000 volts, all of the metal work of the locomotive is very carefully grounded to avoid danger to life.

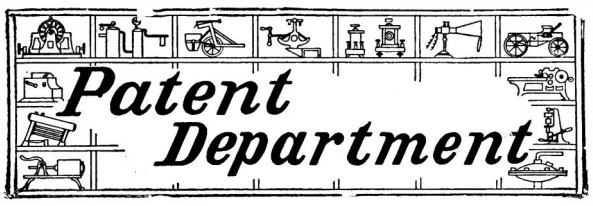
In order to operate the locomotive motors at the low potential of 750 volts, two step-down transformers are installed on the locomotive, as in the case of the Berlin-Zossen road, which was described in the SCIENTIFIC AMERICAN. Many of the devices adopted for the Berlin-Zossen high-speed road were the result of experience gained in this Gross-Lichterfelde experiment. The switch for breaking the 10,000-volt circuit is of the Siemens & Halske high-tension special tube form, a distance of one foot separating the breaking points when the switch is open. These high-tension switches are arranged on the roof of the locomotive, and all of the connections are carefully insulated with porcelain. The three vertical supports on the top of the car each have mounted upon them a bow-shaped aluminium trolley pole or current collector, heavy springs being provided to press the same against the trolley conductors, three of which are suspended one above the other something over a yard apart. The poles with the aluminium bows, which are constructed of this metal for reducing weight as far as possible, are controlled from the cab by the motorman and may be released from the overhead conductors at will. There are three lightning arresters mounted on the top of the locomotive, of the Siemens & Halske horn-shaped type.

The overhead trolley line consists of three conductors mounted on or suspended with insulators and chain from bow-shaped brackets similar to those used on the Berlin-Zossen high-potential line. It will be noted from the accompanying illustration that loops are also used at the supporting insulators, which are intended to ground any of the conductors breaking and falling to the ground. The trolley wires are flexibly suspended, the lowest of the three wires being about 20 feet above the track, and a wire netting is plainly seen in view for guarding against dropping of broken conductors. The overhead line is supplied by a three-phase current at 10,000 volts and a frequency of 50 cycles per second, from a substation equipped with static step-up transformers and motor generators. This road is of particular interest as being one of the pioneer roads using polyphase alternating currents and introducing high potential directly into the moving vehicles.



A SIEMENS-HALSKE THREE-PHASE HIGH-POTENTIAL ELECTRIC LOCOMOTIVE.

The closing of several London theaters on account of the recent fog is not an unprecedented event of British theatrical history, though this last occurrence had an unusual element, due to the fact that the players engaged at these theaters were unable to reach them.



Determining the Frequency of Alternating Currents.

The frequency of an alternating current is usually determined by calculations based upon the number of poles and the special construction and speed of the generator; but since this speed is subject to sudden and inevitable changes, such calculations are only approximate, and cannot be relied upon as affording accurate information of the conditions that may exist at any given instant. Moreover, this means of determining frequencies is not available at transformer substations, or at any point remote from the generator, in which cases there is no practical means by which even approximately accurate calculations can be made. An apparatus has been invented by Hugh S. Carr, of Lawrence, Kans., by means of which the frequency of an alternating current is accurately determined at any time by means of the stroboscope.

The underlying principle of this improved apparatus is that of the stroboscopic effect of a revolving disk divided into alternate sectors having either reflecting or non-reflecting surfaces, or alternate translucent and opaque portions. Mr. Carr has found that, if such a disk be revolved in the light of an arc or incandescent lamp connected with an alternating-current circuit, the slight fluctuations in the intensity of the light due to the variation in the strength of the current will produce the illusion of a revolution of the sectors, whenever the alternations of the current and the revolutions of the disk are not in synchronism. If the number of revolutions per second of the disk be in excess of the number of alternations per second of the current, the apparent revolution of the sectors is clockwise; while if the number of alternations exceeds the number of revolutions the apparent movement of the sectors is counter-clockwise when the disk revolves clockwise. But if the number of revolutions of the disk and alternations of the current are the same, the sectors will appear stationary. This is also true if the number of revolutions of the disk is any exact multiple of one-half the number of revolutions.

A NEW SPRING BLOCK.

Our illustration shows a new spring block recently invented by P. J. Macdonald, of New London, Conn., which should prove of great value to yachtsmen. It differs from the ordinary block in having straps on each side of the sheave slidably fitted into the shell and held under the tension of a spiral spring coiled around a central guide-rod. The straps are joined at one end to form a becket, and at the other end are secured to a cross-piece against which the coil-spring bears. The play of the block is limited by the longitudinal slots in the straps, through which the sheave pin passes. The guide-rod, which is secured to the block proper, passes freely through the cross-piece and may, if desired, be connected with a shackle. The advantages of this block are evident. Its elasticity will prevent wear and tear of ropes and breaking of spars and rigging under the sudden strains to which they are subjected in a rough sea. When a ship is put about or jibed from one side to another the wind pressure is withdrawn, and if these spring blocks be applied to the gaff they will lift the sail and keep it from dragging across the taffrail. Aside from this, the spring gathers up the leach of the sail and greatly quickens the boat's action. This may permit a change in the construction of racing craft, which are at present made with almost too short a keel in order that they may come around quickly. The block should also be of particular advantage in a dying wind, for it will keep the sail flat and prevent the wind from being shaken out by a choppy sea.

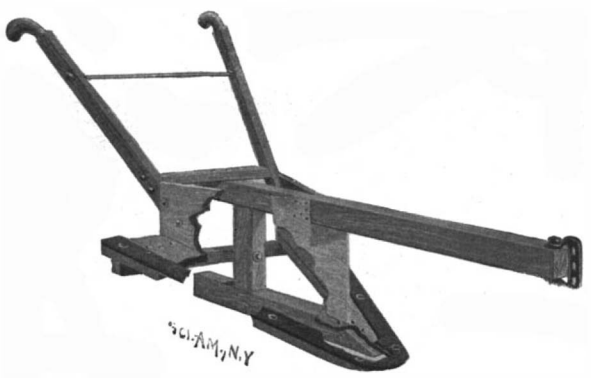
A NEW SPRING BLOCK.

DOUBLE-MOLDBOARD HILLING-UP PLOW.

Our illustration shows a plow so constructed that it will throw up a large amount of loose soil against the stems of sugar-cane or other growing crops planted in rows. The plow can be economically made so that the working of the crops may be inexpensively conducted.

The heel of the beam is provided with a downwardly extending standard, while a second standard extends downward from the beam itself between its center and the heel. A runner is secured to the bottom portions of these standards, the forward portion of which runner is beveled downward and forward.

The moldboard may be termed a "double moldboard," for it consists of a V-shaped central portion formed of two vertical sections, and a marginal flange of a blunt V-shape. The beam passes through a recess at the forward pointed end of the upright section, and the handles are secured to the rear end of the same. The flanged portion rests, at the front, on the beveled end of the runner, and at the rear is supported by a cross-bar.



DOUBLE-MOLDBOARD HILLING-UP PLOW.

The upright sections may be made of wood or metal, as the occasion may demand. The flange portion may be made of wood, with a marginal strip of metal secured to its upper face, as shown in the illustration.

A patent for this plow has been recently granted to B. D. Baldwin, of Maui, Hawaii.

Giebeler Steel.

The publication of the tests made at Charlottenburg with the new steel invented by D. Giebeler, a Mecklenburg manufacturer, shows how exaggerated have been the reports circulated in the daily press both here and abroad. The tests have proved merely that Giebeler has invented a very dense steel which, however, is lacking in the most important property of ductility. It will be remembered that Giebeler steel was claimed to be far superior in hardness to Krupp, Böhler, and Harvey steel. It was furthermore claimed that in cost Giebeler steel was one-third to one-half cheaper than Krupp steel. But exactly what the price of Krupp steel is at the works no one but Krupp knows. For that reason it is difficult, indeed, to institute comparisons so far as cost is concerned. In the Charlottenburg tests the tensile strength fluctuated from 86.6 to 163 kilogrammes. Are these results so very remarkable? Holtzer nickel-steel has a breaking strain per square millimeter of 161 kilogrammes; nickel-steel made by the Société Anonyme de Commentry-Fouchambault et Decazeville, a breaking strain of 153.1 kilogrammes. Moreover these specimens of steel had a ductility of 15 to 16 per cent. Results equal, if not better than these, have been obtained with the best Krupp and Harvey steel.

Another First Invention of the Telephone.

Every country would like to claim for one of its citizens the honor of having invented the telephone. Most of us are familiar with the claims made for Reiss, but no one ever suspected that an Italian would be put forth as the first inventor. Such was the interesting feat performed by Prof. Banti at a recent meeting of the Italian Electro-Technical Association. Mucci is the name of the man to whom Prof. Banti would ascribe the invention of the telephone. Of course the Bell Telephone Company is accused of having gotten possession of Mucci's secret, and of course the drawing and description of Mucci's "acoustic telegraph" are as like those of the Bell telephone as one pea is to another. The Italian Electro-Technical Association was so thoroughly convinced of the truth of Prof. Banti's assertions that they unanimously requested the president to appoint a committee to continue such official researches as would enable them to render posthumous honor to the memory of their inventive countryman.

The Latest Sensation-Machine.

The blasé New Yorker of the East Side, who desires to experience a new sensation, has but to go to Coney Island. There he will find most ingenious apparatus, all warranted to tingle his nerves. On a centrifugal railway he is vertically whirled around in the air at a terrific speed; in a barrel of peculiar construction he may also experience all the bliss to be derived from an ingenious application of the laws governing centrifugal force; and on a "scenic railway" he is shot in and out of tunnels and up and down sharp inclines. All these hair-raising devices must pale into insignificance before an invention which has recently been patented in the United States.

The invention in question is an open submarine boat which is shot down a steep incline and through a tank of water at such velocity that its occupants, although completely submerged, will leave the water just as dry as when they entered it. Obviously this exciter is based on the principle that the velocity of the boat is greater than that of the velocity of falling water, so that the boat is swept through the tank before the water has had time to enter. A short upward incline raises the boat out of the water at the end of the journey.

The Constant Need of New Inventions.

Every home and workshop teems with profitable suggestions to the man with open eyes and mind. In a recent number of Everybody's Magazine, the possibility of inventing new processes and new machines, as the result of such observation is clearly brought out.

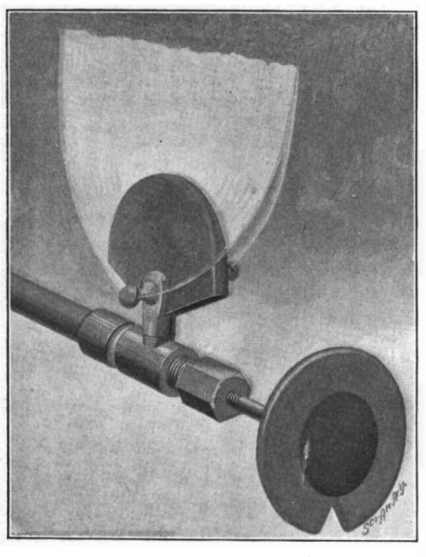
The cost of refining kerosene oil is paid to-day from the despised sludge acid which formerly fouled our rivers and harbors. The waste of the slaughter-house brings in almost as much as the flesh of the animals killed.

Nature has waste products still waiting for use. Prairie wire grass was once one of these. Nowadays it is used in the manufacture of furniture and furnishings. Corn-stalk pith is made into fillings for warships' hulls to close holes made by an enemy's shells.

Somebody should come along and invent a substitute for elastic Para rubber. Celluloid and oxidized linseed oil are fair substitutes for some purposes, but nothing has apparently yet been found that possesses the true elastic properties of India rubber. There is still nothing like leather for shoes; but an inventor may find a substitute to his profit.

HYDROCARBON BURNER.

The hydrocarbon burner here illustrated aims to perfectly vaporize the liquid fuel and attain a complete combustion and a steady bright light without the use of a mantle or chimney. The burner is the invention of G. A. Bonelli, of Kingman, Ariz. A combined generator and spreader is employed, which is comparatively flat and semicircular in shape, its sides tapering to form a blunt edge along the periphery. A hollow shank is formed on the lower portion of the generator and spreader, which is threaded into the burner-casing. Liquid fuel enters the casing through a supply pipe and passes out through the hollow shank into a peripheral passage in the generator. The upper end of this passage opens into a central passage connecting at the bottom with two burners. The burners are disposed on opposite sides of the generator and spreader and, when in use, direct the burning fuel against its inclined faces, so as to heat the generator and thoroughly vaporize the liquid. When the flames strike the spreader they spread over its opposite faces, and unite at the periphery in a single bright and steady flame. The amount of liquid fuel passing into the casing is controlled by a needle-valve, and impurities are prevented from entering the burners by screens placed in the casing and at the mouth of the generator shank.

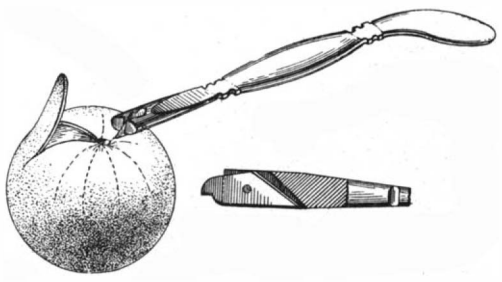


HYDROCARBON BURNER.

SIMPLE AND INTERESTING INVENTIONS.

ORANGE PEELER.—A simple device for scoring and peeling oranges is shown in the accompanying illustration. The invention is that of J. E. Crandall, of Brooklyn, N. Y., and consists of a handle-portion having a scoring-knife at one end and a peeling-blade at the other. At the scoring end the handle is brought into a cylindrical form which is slotted longitudinally. In this slot the scoring-knife is pivoted, its cutting edge inclining from a point within the slot, downward and forward, to a point slightly beyond the end of the handle.

When desired the blade can be turned on its pivot and housed, as shown in the sectional view, and will be safe from injury and cannot cut the hand. In both the open and closed positions, the unsharpened end of



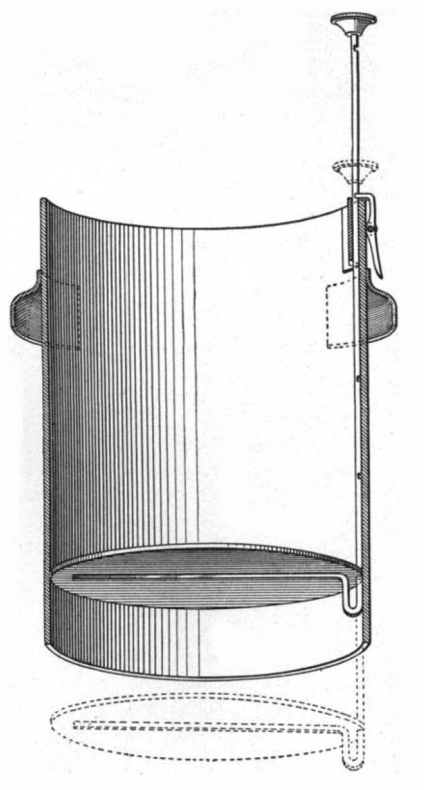
ORANGE PEELER.

the knife projects from the handle and serves as a means for turning the blade on its axis. When the knife is open this unsharpened end rests against the top of the end wall of the slot and acts as a stop to prevent the knife from swinging forward too far. The knife is pointed at its forward end, so that it may be readily forced into the orange skin, and projects just far enough to cut the orange skin without injuring the pulp. The fruit may be peeled by slipping the peeling-blade, at the other end of the instrument, between the skin and the pulp. This flat blade curves downward so that it can readily follow the contour of the orange. By means of this instrument the orange may be scored

TELESCOPIC GUNSIGHT.

neatly, as shown in dotted lines, and the skin turned back to give the fruit a very tasteful and appetizing appearance.

MEASURING VESSEL.—An inventor who lives in Indianapolis has devised a vessel, the capacity of which can be varied and the contents discharged, not at the top, but from the bottom. An adjusting-rod is mounted in the receptacle and carries a bottom plate, the free side of which is inclined upwardly. By means of a catch, which is designed to enter any one of a series of notches formed in the rod, it is possible to hold the rod in any desired position. The notches are so arranged that the plate can be adjusted so that the vessel will contain one peck, a half a peck, etc. As soon as the material is placed in the receptacle, the plate yields slightly, the lower end of the rod being thrown against the wall of the vessel, thus forming a brace for the plate. By releasing the rod the weight of the material will move the plate down through the bottom.



A VESSEL THAT MEASURES LIQUIDS.

BUG TRAP.—The ants or bugs that climb up the legs of a chair or bed fitted with a trap invented by Patrick J. McAtee, of Gilberton, Pa., will never travel far. They will encounter a turpentine-filled drum supported on the castor. In order to walk up the leg of the chair or bedstead the ant or bug must pass up through a circular opening in the bottom of the drum, until stopped by the upper interior surface of the drum. This surface is roughened so that the bug will adhere to it with no danger of falling back through the opening in the bottom. The rest of the upper wall is smooth so that the bug will lose its foothold and fall into the turpentine. The bottom of the drum is also smooth, and is conical in shape, in order to prevent the bug from crawling along its under surface, if perchance it should happen to drop onto the edges of the circular opening.

SPRING ICE SKATE.—An improved skate, which should appeal to all skaters, has been recently invented by Robert Bustin, of St. Johns, New Brunswick, Canada. The invention is of particular advantage in connection with racing skates. The foot piece, which consists of a plate of thin spring metal, is rigidly secured at the instep to the runner. Its two ends, however, are connected to the runner by a yielding support. The runner is formed with two vertical spindles, one at each end, which are adapted to enter openings in the foot-plate. Coil springs on these spindles bear against the under-surface of the foot-plate and are sustained by shoulders on the spindles. The foot piece is retained by cotter-pins which pass through holes in the upper ends of the spindies. The advantages of this arrangement are evident to the fancy skater. It is sometimes necessary, in performing difficult evolutions, that the motion of the fort part of the foot-plate should not be transferred to the rear of the plate, and vice versa. The rigid support near the center of the skate insures a distinct independent motion to each part of the foot-plate. The construction of the skate is such that different styles of runners may be easily attached to the foot-plate.

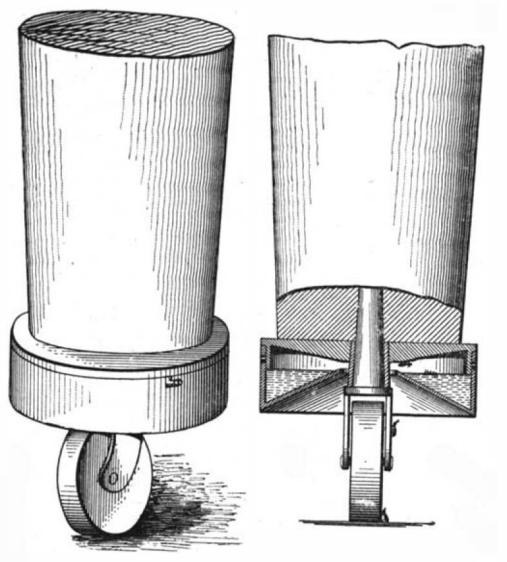
TELESCOPIC GUNSIGHT.—The range of the human eye has not developed with that of the firearm, for which reason it has been a difficult matter to obtain accuracy of aim at great distances. In order to assist our defective eyes, an inventor has hit upon the idea of mounting a telescope upon the gun. The result is that not only is the object brought apparently much nearer, but the marksman can fire with considerable accuracy at twilight or dawn, at a time when the ordinary sights fail him. The telescope is mounted by a front support transversely adjustable, and on a rear support capable of horizontal and vertical adjustment.

Inventor of the Lucifer Match.

There have been many claimants to the honor of being the maker of the first lucifer match. But a recent discovery of some old account books at Stockton-on-Tees, England, affords documentary evidence which proves beyond question that one John Walker, a Durham chemist, was the original inventor and maker of the match. According to a diary, in which Walker carefully noted all his business transactions, the first box of matches was sold for thirty-five cents in April, 1827. It appears that they at once became popular, and people traveled from the adjacent towns to purchase them. Walker employed the poor of Stockton to split the wood, but dipped them in the phosphorus mixture himself to insure their perfection. The inventor was pressed by his friends to patent the process; he refused, however, affirming that he had ample means to satisfy his simple wants.

A Simple Current Transformer.

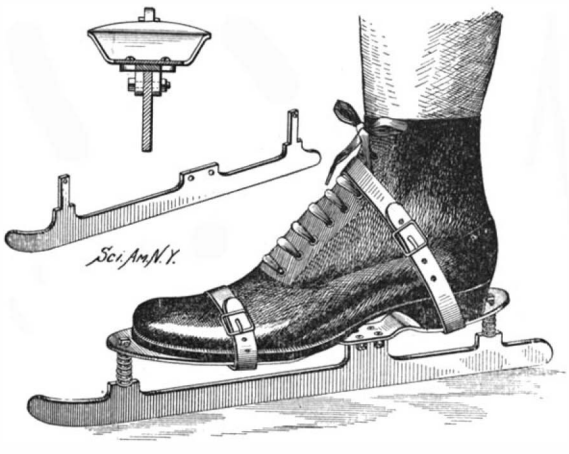
Since current transformers are used in connection with armatures, their function being to transform a current of large volume flowing under the influence of a high voltage down into one suitable for proportionate measurement by the ammeter, it is of the greatest importance that the apparatus should possess great precision of regulation. The nicest accuracy of transformers operating at low loads, such as the ammeter provides, is attained in transformers having a magnetic circuit of minimum length, or, in other words, a core without any unnecessary air gaps and of such shape that it has the least possible length. In such a magnetic circuit there will be less leakage, less core loss, and therefore better regulation. Furthermore, less material will be required in the construction of the core. It has been customary to construct current transformers with a core adapted to be slipped over the ordinary switchboard bus-bar, which, as every electrician knows, consists generally of a wide, flat copper strip and which might carry, for example, 1,000 amperes or more. In such cases the bus-bar constitutes what is known in practice as a "single-turn primary." The General Electric Company has acquired from Augustine R. Everest an invention in which the core consists of an assemblage of symmetrical sheet-metal punchings or laminæ, which are preferably in the form of rings; and this core provides the shortest possible magnetic circut. In order to provide a uniform air-gap between the core and the primary, the latter is preferably constructed to have an exterior outline similar to the interior configuration of the core. The inventor states that a transformer provided with a primary having its cross-section of any symmetrical figure will possess some of the advantages of his invention; but the factors of regulation and economy will increase in proportion to the number of sides of such symmetrical figures, so that the factors are attained in the highest degree by an annular core and a cylindrical primary surrounded thereby. Inasmuch as the length of the primary within the core is very short compared with the bar to which the primary is secured, the current density of the primary can be considerably higher than in the bar, so that by reducing the size of the primary to a minimum, the length of the magnetic circuit and the amount of core material can be reduced to a minimum, while the highest degree of accuracy is attained. Furthermore, since the primary is of short length with respect to the bus-bar, it is not absolutely essential that the primary be made solid, for in some instances a hollow primary will operate satisfactorily, owing to the so-called "skin effect" of the alternating current with which the transformer is used. To the ends of the primary above described are secured metallic pieces or flanges which can be mounted upon the ordinary oblong bus-bar, so that there is thus provided a complete independent apparatus capable of being applied in any desired place.



BUG TRAP.

The New Australian Patent Law.

The Commonwealth of Australia was inaugurated on January 1, 1901; and the customs, postal, and defense departments were taken over from "the States" to Federal control, this being provided for in the Federal Enabling Act. But patents, however, cannot be taken over for lack of a suitable patent act. In May last an official convention of the Patent Commissioners of South Australia, Victoria, New South Wales, Queensland and Tasmania, was held, as the result of which a Federal patent bill was prepared and handed to the Attorney-General. No one knows the nature of this bill. Patent agents of Australia have urged the importance and early introduction of a Federal patent act; and the ministry as a result have authoritatively stated that a law will be sooner or later passed. In the meantime, therefore, the patent laws of the six States remain in force until 1903, and possibly later. The new law, whenever it will be passed, will sanction the granting of one patent for the entire Commonwealth; six patents are now necessary.



SPRING ICE SKATE.

Legal Notes.

Edison and the Mutoscope in Court.—The decision which was handed down in the United States Circuit Court of Appeals on March 10, by Judge Wallace, probably marks the termination of a bitter strife that has been waged by Mr. Thomas A. Edison against rival makers of moving picture apparatus. Mr. Edison was one of the first to secure patents on a chronophotographic apparatus. When other manufacturers of similar devices entered the field, a series of legal battles began in which Mr. Edison uniformly triumphed. For years he has received royalties from companies which are said to amount to many thousands a year. The last alleged infringer of the Edison patents to be attacked was the American Mutoscope Company. A decision was first rendered in favor of Mr. Edison in the United States Circuit Court. But the opinion now handed down by Judge Wallace on appeal reverses the decision of the lower court, and declares not only that the American Mutoscope Company has not infringed the Edison patent, but even that Edison invented no new combination worthy of a patent. What Edison claimed was the use of a continuous film upon which the moving object was photographed. In order to refute the claims of Edison to priority of invention, the Court dwelt long and learnedly on the history of chronophotography, and pointed out that as far back as 1864 a Frenchman named Du Cos had invented a moving picture machine very much like Edison's. A similar apparatus was patented in this country in 1866 by Le Prince. The Court said:

"It is obvious that Mr. Edison was not the pioneer in the large sense of the term, or the more limited sense in which he would have been if he had also invented the film. He was not the inventor of the film. He was not the first inventor of apparatus capable of producing single negatives taken from practically a single point of view in single line sequence upon a film like his and embodying the same general means of rotating drums and shutters for bringing the sensitized surface across the lens and exposing successive portions of it in rapid succession.

"Du Cos anticipated him in this, notwithstanding he did not use the film. Neither was he the first inventor of apparatus capable of producing suitable negatives and embodying means for passing a sensitized surface across a single lens camera at a high rate of speed and with an intermittent motion, and for exposing successive portions of the surface during the periods of rest. The predecessors of Edison invented apparatus; no new principle was to be discovered, and essentially no new form of machine invented in order to make the improved photographic materials available for that purpose. The early inventors had felt the need of such material, but in the absence of its supply had either contented themselves with such measure of practical success as was possible or had allowed their plans to remain on paper. Undoubtedly, Mr. Edison, by utilizing this film (not, however, his invention) and perfecting the first apparatus for using it met the conditions necessary for commercial success. This, however, did not entitle him under the patent laws to a monopoly of all camera apparatus capable of using the film."

Legitimate Repair of a Patented Machine by a Purchaser.—That the purchaser of a patented machine has the right to make necessary repairs, which are legitimate, without encroaching upon the patent, would seem to be a principle founded upon common justice. But at what point legitimate repair ends and illegitimate reconstruction begins is a matter that has given our Federal courts no little trouble. Recently the question came up once more before the Circuit Court of Appeals for the First Circuit, in the case of Goodyear Shoe Machinery Company vs. Jackson. The very scholarly opinion handed down by Judge Colt in favor of the defendant is so shrewd a commentary on the right of repair that a digest of his views may be of some interest to our readers.

The point to be decided is not whether the purchaser has a right to make repairs, but how far that right may be exercised. When the patent is for a single thing, such as a knitting-needle, obviously the renewal of an old needle in a knitting-machine is not repair, but a reproduction of the patented thing. When the patent is for a device embracing a combination of several elements a purchaser will infringe by reconstructing the device after it has fulfilled its purpose and is substantially destroyed. When the patent is for such a machine, the question of infringement by the purchaser will depend upon the condition of the machine—whether it be only partly worn out, or entirely worn out and so beyond repair. In the case of a patent for a planing-machine composed of many parts, it was held that the renewal of the rotary knife, or the effective ultimate tool of the machine, was repair and not reconstruction. In the case of Wilson vs. Simpson (9 How. 109) the Supreme Court states two fundamental principles on which the rights of a purchaser of a patented machine are based: (1) the right of the owner to renew a material part of the patented combination; (2) and the right to renew a part of the machine that, it was known, would quickly wear out, such renewal being necessary to the continued use of the machine, and therefore contemplated by the patentee when the machine was sold. In that case the Court said: "When the material of the combination ceases to exist, in whatever way that may occur, the right to renew it depends upon the right to make the invention. If the right to make does not exist, there is no right to rebuild the combination. But it does not follow, when one of the elements of the combination has become so much worn as to be inoperative or has been broken, that the machine no longer exists for restoration to its original use by the owner who has bought its use. When the wearing or injury is partial, then repair is restoration and not reconstruction. . . . Repairing partial injuries, whether they occur from accident or from wear and tear, is only refitting a machine for use; and it is no more than that, though it shall be a replacement of an essential part of a combination. It is the use of the whole of that which a purchaser buys when the patentee sells to him a machine; and when he repairs the damage which may be done to it, it is no more than the exercise of that right of care which everyone may use to give duration to that which he owns, or has a right to use as a whole. . . . And what harm is done to the patentee in the use of his right of invention, when the repair and replacement of a partial injury are confined to the machine which the purchaser has bought?

"Nothing is gained against our conclusion by its being said that the combination is the thing patented, and that when its intended result cannot be produced from the deficiency of a part of it the invention in the particular machine is extinct. It is not so. Consisting of parts, its action is only suspended by want of one of them, and its restoration produces the same result only, without the machine having been made anew."

Brush Storage-Battery Suit.—Sitting in the United States Circuit Court for the Northern District of New York, Judge Coxe handed down a decision in an action brought by the owners of the Brush patent, the Electric Storage Battery Company, against Eugene W. Belknap, the American Bicycle Company, and the National Battery Company. Few patents have been so frequently before the courts. For more than a dozen years the Brush patent has been the subject of fierce and persistent attacks; invariably has it been sustained. The defendants introduced affidavits tending to show that the electrodes are made by the forming process described by an Italian patent granted to Brush, which patent has expired. The controversy was limited to the single proposition, "Was the defendants' electrode the one described in the expired Italian patent?" The scope of the invention and the construction of the claims had been decided upon in previous litigations. The effect of the expiration of the Italian patent upon the patent in the suit received careful attention both in the Circuit Court and in the Court of Appeals. It was held that the patent in suit covers the pioneer invention of Mr. Brush made prior to the winter of 1880, and that the Italian patent relates to an entirely different and subsidiary invention made in the spring of 1882. The defendants' electrode was made, according to the Court, pursuant to the formula of a patent granted to Elmer A. Sperry, October 23, 1900.

New French Patent Regulations.—The new ministerial decree which has recently gone into effect has modified the patent system of France in certain important respects.

In order to obtain a patent in France, the invention must be absolutely new, industrially useful, not injurious to the public peace, or to the laws of the country. An invention is not considered new if, prior to the date of filing the application, it has received sufficient publicity in France or abroad to render its imitation easy.

The decree to which we have referred concerns the drawings and description of the invention. The provisions are of such a nature that only a skilled patent attorney can comply with them to the letter. For the first six months of 1902, the decree will not be applied in an absolute manner.

By the law of 1844, an inventor who has obtained a patent must work his invention in France within two years after the date of the patent. The Lyons bench has decided that this working must be real, and that publicity due to the assignment of a patent is not sufficient.

The Asphalt Case.—In 1893, Amos Perkins received a patent for a method of repairing asphalt pavements. In his broad claim he stated that his method consisted "in subjecting the spot to be repaired to heat, adding new material and smoothing and burnishing it." The validity of this Perkins patent recently came up for determination before the Supreme Court of the United States in the matter of the United States Repair and Guarantee Company vs. The Assyrian Asphalt Company. In the first place the Circuit Court and the Circuit Court of Appeals found that a prior French patent issued in 1880 had anticipated the invention of Perkins, the similarity, if not identity, of the two patents being very manifest. It was claimed that the Perkins method is to be distinguished from the French method because the asphalts to which the two inventions respectively apply differ. The answer given by the Court was that the patent did not support this contention. To devise a machine for applying heat in the proper manner might be invention, but to allow still more, the Court held, would be to give a monopoly of the machine and of that which the machine can do. In view of the prior publications the Court held that the Perkins patent was invalid and that the Assyrian Asphalt Company could not be held to have infringed.

A Peculiar Druggist's Case.—In the Supreme Court of Iowa an opinion has been handed down on a case in which the liability of a pharmacist is defined when he furnishes, without caution or advice, but properly and lawfully labeled, an article called for, and an accident resulting in bodily injury to the purchaser subsequently occurs through ignorance of the dangerous character of the article. The case was that of Gibson vs. Torbert. Gibson, having heard that phosphorus was used as a "harmless illuminant," mailed fifty cents to W. H. Torbert, with the request to send phosphorus to that amount. The druggist bottled the phosphorus properly, labeled the bottle as prescribed by law, and expressed it to the plaintiff. Ignorant of the nature and properties of phosphorus, Gibson, when he received the package, opened it, and examined the contents with his naked hand. One of the sticks fell, and as he stooped to pick it up spontaneously ignited, thereby setting fire to the remaining phosphorus and thereby severely injuring him. Suit was subsequently brought against Torbert to recover damages for the injuries sustained. When the case first came up Torbert demurred and was sustained. The case was then carried to the Supreme Court of Iowa and the Court below was sustained, no negligence having been proven on Torbert's part.

Fraudulent Imitation.—A preponderance of the testimony showed that defendant manufactured bitters and sold the same in bulk as Hostetter's Bitters, which were manufactured only by complainant in accordance with a secret formula, and advised purchasers to put the same in empty Hostetter bottles, which evidence was reinforced by testimony of a statement made by defendant's employé that he manufactured the bitters sold by defendant in imitation of complainant's, and by the fact that defendant failed to produce such employé as a witness, without any adequate excuse. Held—that such evidence was sufficient to sustain complainant's charge of fraud and unfair competition. Hostetter Co. *vs.* Conron, 111 Fed. Rep. (U. S.) 737.

Evidence of Copyright Infringement.—Infringement of a copyright may be shown by all kinds of evidence, and especially by the resemblance between the two works; but the presumption resulting therefrom is not so strong where the work consists of compilations of facts and statistics taken from books on which the copyright has expired. When, in addition to the resemblance between a copyrighted book and one which is claimed to infringe it, there is shown an intent on the part of the author of the second work to appropriate the labors of the author of the first work, the presumption which results therefrom constitutes proof of infringement. Beauchemin vs. Cadieux, Rep. Jud. Que., 10 B. R. (Can.) 255.

Infringement of Trade Mark.—Plaintiff's trade mark, consisting of two fields united by a bar wider in the middle than at its ends, and of a Maltese cross, with a stag's head on its face, placed over the bar, was infringed by a trade mark of two fields joined by a bar, especially similar in outlines to plaintiff's, only it was inverted, and had above the bar an enlarged stag's head, without the Maltese cross. It was immaterial, as affecting the question of infringement, that the respective trade marks bore the respective names of the plaintiff and defendant. Dunlap & Co. vs. Young, 74 N. Y. Supp. 184.

Assignment of Patent.—The assignee of a patent right, for a limited period with the right of purchase, who at the expiration of such period elects not to purchase and reassigns the patent, cannot thereafter sell the patented article, though made by him during the time he was assignee, as his right to make and sell is to be restricted to the period limited. Bennett vs. Wortman, 2 Ont. Law Rep. (Can.) 292.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ADJUSTABLE ELECTRIC-LIGHT SUPPORT.—E. E. WALTERS, Lehighton, Pa. The support comprises a number of tubes adapted to telescope within each other as the lamp is raised. The electric lamp is attached to the bottom of the innermost tube. The conducting wires pass up through the tubes and are coiled up on a spool at the top of the support, the ends of the wires passing down through the body of the spool to the core, whence, by frictional connection, they receive electric current from the two other conductors. The spool is rotated by a coil-spring, to take up all slack wire when the lamp is raised. Thumb nuts are employed to lock the spool and hold the lamp at any desired height.

ELECTRIC CALL.—J. SALMON New York, N. Y. The invention is designed for use in hotels, to awaken guests at any desired time. Each room is provided with a bell, which may be so connected to a clock as to ring at any predetermined hour. A clapper, operated by the clock, makes connection with a battery, which runs a small motor, and rings a bell until the motor automatically shuts off the current.

Games.

GAME APPARATUS.—D. SMITH, Griffin Corners, N. Y. The game apparatus constitutes a miniature bowling-alley, arranged on a folding table, so that it may be conveniently employed in any room of a dwelling. The balls are thrown by a spring-actuated plunger, and return by gravity along grooves at each side of the alley.

DESIGN FOR GAME-BOARD.—F. B. HOLLISTER, Mount Morris, N. Y. The design consists of a star-shaped board divided into squares. The squares in the several corners are provided with distinguishing marks. An isolated square in the center is also provided with a distinguishing mark.

Mechanical Devices.

MUSIC-LEAF TURNER.—C. H. DASCOMB, El Paso, Tex. A base is employed which may be supported on the music-rack of an organ or piano. At its upper side the base is adapted to receive a book or sheet-music. Bars, pivoted at each end of the base, are used for clamping back the covers of the book. A series of bars are pivoted at the center of the base, and have mounted on their outer ends, the carriers, consisting of pairs of wire bows between which the sheets of music are clamped. Each carrier bar is controlled by a button, so that when a button is pressed in, the corresponding carrier is actuated, by rack and gear, to swing on its pivot and turn the page of the book, or the sheet of music which it carries.

AUTOMATIC CUT-OFF FOR MILL POWER.—B. STRITTMATTER, Carroll Township, Pa. This device is particularly adapted for connection with so-called air-motor-power windmills, and automatically cuts off the power when the grain to be ground becomes low, or nearly discharged from the hopper. A paddle is hinged to the bottom of the hopper, and is held down thereto by the weight of the grain above it. When the grain becomes low, the paddle, relieved of its weight, swings upward and, by means of a series of levers, disengages a clutch and stops the mill.

ORE CONCENTRATOR.—W. THURMOND, Hillsboro, N. M. A draft-chamber is employed, opening at one end into a suction-box having at its upper end an exhaust fan. An inclined wire screen is situated under the lid of the draft chamber, and is mounted to rock on suitable rollers. The meshes of the netting increase in coarseness toward the bottom of the screen. Beaters are used along the under surface of the screen, to assist in sifting out the ore. The material moves by gravity down the screen, the lighter particles passing through into the draft chamber and being blown over a screen plate which further sifts them out. All that remains on either the wire screen or the screen plate, is drawn into the suction box and passed over two receptacles. The heavier particles drop immediately into the first receptacle and are conveyed, by an elevator, back to the roller machine. The remainder, which enters the other receptacle, is carried out to the dump.

CLARIFIER.—L. LITTY, Donaldsonville, La. The invention is an improvement on apparatus for automatically clarifying the juice of sugar-cane, beet sugar, etc. The juice is poured, through a pipe, into a tank divided into two compartments. At the bottom of each compartment are coils of steam pipes which heat the liquid. The exhaust steam from the coils operates a motor which imparts motion to a paddle. The paddle drives the scum over to an endless conveyor which carries it over a screen, into a trough above. The screen drains out whatever liquid may have been carried up with the scum.

Tools.

MICROMETER GAGE.—J. STROMBERG, Phœnix, Ariz. Ordinarily micrometer gages have to be constructed in different sizes, each with a range of one inch only. In this micrometer, by the use of extension-rods, a single instrument may accurately measure any length desired. The extension-rods are secured by suitable means to the measuring screw. Means are also provided for adjusting the anvil, in order to insure accuracy of the gage.

SCREW DRIVER.—T. A. FARRELL, Chicago, Ill. The invention has for its primary object the provision of improved means for holding a screw firmly in engagement with a driver spindle. The holding means rotates with the driver while inserting the screw, but is capable of disengagement, in order that the driver may force the screw home into the work. A simple and effective means is employed for locking the screw holder to the driver-spindle, and for readily unlocking the same.

DRILL.—R. BINNIE, Bolivar, Pa. Two patents have been granted to Mr. Binnie for improved drills adapted for work in coal, clay, and other soft minerals. In the first invention the drill is mounted on posts. The drill rod is driven by a combined rotary and reciprocal movement, and at the same time is gradually fed forward to its work. This movement adapts it to a bit of any character, either a boring-tool or a chiseling tool. For if an ore ball or lump is struck, the boring need not be abandoned, but the chiseling tool may be applied and the work carried on as before. In the second invention, the drill is mounted on a tripod in such a way as to work against a bank of any possible disposition. Improvements are also made in the forward feeding device.

TACK OR NAIL PULLER.—E. HANNER, Ridgway, Pa. The tool consists of a body or handle portion in which is mounted the tack-puller proper. The latter consists of a lever, terminating in a head block from which the claw foot projects. The head block rests on rollers, and has trunnions which are adapted to turn in the slots in the side walls of the handle portion. These parts mutually coact to give an initial forward movement to the claw, and afford a vertical pull after the claw has passed under the head of the tack.

Miscellaneous Inventions.

LOOSE-LEAF LEDGER.—ALMON B. WELLS, 515 L Street, N. W., Washington, D. C. The invention relates to that class of blankbooks in which any leaf in the book can be removed and another substituted. The invention is an improvement in this class of devices, which is applicable to all kinds of blankbooks, and which is so constructed as to permit the leaves of the book when opened to lie flat in a convenient position for the accountant, instead of bending with an awkward curve in the middle.

CIGAR.—J. D. TYNEN, Spooner, Wis. A cigar loses much of its strength and flavor by exposure to the atmosphere. This cigar is made with two tobacco wrappers wound reversely to each other. The outer wrapper is of no value for smoking, but is of special value for hermetically sealing the cigar, and is designed to be taken off and cast away before the cigar is smoked.

BASKET.—T. J. LANGSTON, Johnston, S. C. The invention consists of a folding basket in which the body portion is supported by a frame, so that it can be extended for use, and compactly folded with the frame when not in use.

TREE SUPPORT.—T. P. BROWN, Riverside, Cal. The invention relates to means for supporting the heavy fruit-laden limbs of trees. A straight prop-pole is used, to which a number of hanger-strands are secured. Bracket-hooks are placed under the limbs and slid up the strands until the latter are taut, and then the hooks are secured by a simple clamp.

ANIMAL TIE.—J. T. HORRIS, New York, N. Y. The tie is designed particularly for horse-stalls, and aims to give the animal perfect freedom when standing up or lying down, with no danger of its becoming tangled up in the tying device. A carriage is mounted to slide on a vertical guideway at the side of the stall, and to this the halter-chain is connected.

BED.—W. D. OLNEY, Stillwater, Minn. The bed proper is capable of being folded up into a cabinet. A counterweight is employed to raise the bed. This is thrown out of operation by drawing the cot away from the cabinet. When it is desired to close the bed the cot must be shoved back into the cabinet.

MITTEN.—W. L. POLLARD, Rozetta, Ill. The mitten is especially adapted for use in husking corn. It is economically designed and constructed with no seam between the palm and thumb.

PORTABLE DARK-ROOM.—ALBERT WERNER, Liberty, N. Y. The improved portable dark-room consists of a box to which is hinged a cover provided with a pane of red or orange glass. By means of two flexible sleeves attached to the box, the operator may pass his hands therein and manipulate his plates. Suitable devices insure a constant supply of fresh air, and enable the photographer to temporarily withdraw from the main box, without danger of light striking a plate in the process of developing.

BLASTING FUSE.—N. HARRIS and J. BRAY, Russell Gulch, Col. The fuse differs from the ordinary in having branching combustible members spaced at intervals along the cord. These members when not used can be wrapped around the main fuse. Their object is to permit the fuse to be readily ignited, and any desired length can be put between the igniting point and the detonating cap.

ROTARY FURNACE.—CHARLES GROLL, 126 Rue du Grand Chemin, Roubaix, France. The grate is formed by a series of independent bars curved in the form of an arc of a circle and arranged concentrically. These bars rest on a series of radial bars secured to a center-piece, but free to expand on the heel pieces at their outer ends. Each curved bar is provided with a narrow notch which receives a radial bar snugly therein. It is also provided with wide notches which receive the other radial bars, thus permitting free expansion. The grate is operated by a rack and gear.

PROTECTING ATTACHMENT FOR LEGS OF TROUSERS.—B. F. SALMON, Freeland, Pa. The invention is designed particularly for the use of miners and consists of a waterproof cap-piece which is sewed to the trouser-legs, and is adapted to cover the knees and close the top of the boot.

PROCESS FOR PRESERVING WOOD.—I. B. SPRAGUE, Everett, Wash. Iron nails, which have been rusted by being laid in a salt solution, are driven into the wood about two inches apart all around. Iron filings are then pressed into the wood and rusted by a salt solution. This gives the wood a hard gritty coating which preserves it and protects it against the distructive action of teredoes.

PADLOCK.—J. J. COTTER. Bowerston, Ohio. This invention provides a lock-casing so constructed as to prevent the entrance of water, thus obviating any danger of ice forming in the lock in cold weather, which would interfere with the working parts. In the lock mechanism, an auxiliary locking-dog is provided for the tumblers, which prevents picking the lock.

CRATE.—A. VON SCHLUEMBACH, Martinsburg, Pa. The crate, which is especially adapted for carrying live fowls, may be folded when empty so as to occupy a very much reduced space, thus facilitating its transportation. A water-trough of canvas, or other waterproof fabric may be employed at one end of the crate.

SECTIONAL CULVERT.—F. A. SICKLESTEEL, Northbranch, Mich. The invention provides an improved sectional culvert designed for use on highways and railways, and is arranged to be conveniently set up without the aid of skilled labor. It consists essentially of a base, and sectional arched side pieces seated at their lower edges in the base. The upper edges of the side pieces are serrated, and have alternately-disposed bevels which interlock with each other.

CHEESE-BOX.—W. A. SIMISTER, Ingersoll, Canada. This improved cheese-box is constructed to prevent ripping or splitting of the box. It is so arranged that both heads can be removed, to allow of readily placing the cheese in the box. The heads are so locked in place that they can be conveniently removed, to allow inspection from either end, without destroying the box or injuring the cheese.

CASH-BOX.—J. J. PEETZ, Galveston, Tex. The cash-box comprises a box proper having a glass front. A chute, for receiving coins, projects through the upper portion of the box, and is curved, so as to prevent the possibility of extracting the coin. A trap door covers the end of this chute, which will open under the weight of the coin. The box is divided, by a false bottom at its center, into two compartments. The false bottom has two hinged doors, which open downward under the weight of the coins, and permit the latter to drop into a cash drawer. The box also contains a cash register, which is operated by a crank-handle at the side.

FOLDING COMMODE STAND AND SEAT.—J. H. PRENTICE, Brooklyn, N. Y. This commode seat, which is especially designed for the use of children, may be conveniently carried from place to place in the form of a small parcel, or may be packed in a medium-sized traveling bag. It consists of but three parts, a seat, and two folding supports which are utilized as upright side members. The hole in the seat is beveled on both faces, so that it may be placed upside down upon the seat of any water-closet, to reduce the size of the opening therein.

PIPE-COLLAR.—E. J. MALLEN, New York, N. Y. This improved collar or ceiling-plate has been designed for use on steam pipes and is meant to cover openings in the ceilings or floors, through which they pass. The opening is covered by a plate which snugly fits the pipe, and is held in place by spiral springs wound around guide rods. These rods project through the plate at one end, and at the other end are secured to L-shaped arms which are fastened to the pipe by a clip.

PROCESS FOR TREATING MATERIALS TO MAKE THEM WATERPROOF.—A. H. HIPPLE, Omaha, Neb. The invention is a process for rendering asbestos waterproof. Sixty parts, by weight, of linseed oil, and twelve of sulphur are used for every one hundred parts of asbestos. The mass is then vulcanized at a temperature of 300 deg. F. for two hours.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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We develop inventions through their several stages, manufacturing for the market. Amstutz Osborn Co., Cleveland, O.

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FOR SALE.—Lately patented "necktie fastener," a meritorious article. Address Ernst Kiene, Box 1029, Spokane, Wash.

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WANTED.—To manufacture special parts of machines, or anything that can be done chiefly on the lathe. Geo. W. McKenzie, Wilmington, Mass.

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Competent draftsman familiar with steam plant work wanted temporarily. Apply by letter to Clark Thread Company, Clark and Ogden streets, Newark, N. J.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

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WANTED.—Foundry chemist who can also superintend cupolas and produce iron at lowest cost. Young man preferred. Stover Manufacturing Company, Freeport, Md.

Inquiry No. 2270.—For prices and particulars of the White electric plant manufactured by the Globe Iron Works Company.

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Business man having best knowledge of European trade will undertake to sell patents, rights, licenses, etc., on commission. Will act as agent for first-class firms. Address P. F. P., Box 773, New York.

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Superintendent, or assistant superintendent, of a manufacturing plant (new or old), one where trouble exists preferred, by a man who would show his ability in handling men, his knowledge of mills, their construction, repairs and maintenance, his practical chemistry, in short where his 15 years' experience in mills will be of mutual value; is still willing to learn; best of references. X. Y. Z., Box 773, Scientific American Office, New York.

Inquiry No. 2277.—For dealers in cottonseed oil machinery.

Inquiry No. 2278.—For the manufacturers of the "Elgin Alligator Wrench."

Inquiry No. 2279.—For machines to cut and finish slats for Venetian blinds of about 78 inches wide.

Inquiry No. 2280.—For dealers in the Phillips Morse Automatic Telegraph.

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Inquiry No. 2282.—For dealers in Java and artificial indigo.

Inquiry No. 2283.—For a machine for printing on calico.

Inquiry No. 2284.—For dealers in weaving and knitting machines.

Inquiry No. 2285.—For dealers in manual training tools.

Inquiry No. 2286.—For soap molds, etc., for making soap.

Inquiry No. 2287.—For manufacturers of refrigerating machinery.

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(Continued on page 213)

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"Malt Myrrh," for malt tonic liquor, Barrett & Barrett	9,021
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"Royal Welsh Sauce," for sauce, J. Marshall	9,011
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"The American Corset Waists," for corset waists, H. Greenberg et al.	9,008
"The Cardinal Kidney Cure and Tonic," for a medicine, C. W. Johnson	9,013
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"Trunk Matches," for matches, L. Hilfer	9,010
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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS, ETC.

THE MANUFACTURE OF LAKE PIGMENTS FROM ARTIFICIAL COLORS. By Francis Jennison, F.I.C., F.C.S. London: Scott-Greenwood & Co. New York: D. Van Nostrand Company. 1901. 8vo. Pp. 136. Price $3.

The term "lake color" is used to distinguish pigments made from dye stuffs and coloring matters by precipitating the coloring matter as an insoluble compound which can then be used for pigmental purposes to distinguish them from natural pigments, such as ochre, umber, etc., and from chemical colors manufactured by direct combination or decomposition of distinct salts, e. g., such colors as lead chromates, Chinese blue, emerald green, etc. This is a very valuable treatise and is accompanied by plates containing samples of papers treated with lakes. There are sixteen plates. It is a most successful and valuable contribution to the literature of technology.

MANUFACTURE OF MINERAL AND LAKE PIGMENTS. By Dr. Josef Bersch. London: Scott-Greenwood & Co. New York: D. Van Nostrand Company. 1901. 8vo. Pp. 476. Price $5.

The present volume contains directions for the manufacture of all artificial artists' and painters' colors, enamel colors, soot and metallic pigments and is a text book for manufacturers, merchants, artists and painters, and is translated from the second revised edition by Arthur C. Wright, M. A. We hardly know any branch of chemical technology which has made such wonderful advances of late as the manufacture of colors. A large number of pigments have been recently discovered, distinguished by beauty of shade and permanence. The chemists are continually endeavoring to replace handsome and poisonous colors by others equally handsome but non-poisonous. The author has avoided the receipt "fetish" and has endeavored to make clear to the reader the chemical processes to which regard must be had in the manufacture of the different pigments. The treatise is the best we have ever seen upon the subject.

ALASKA. NARRATIVE, GLACIERS, NATIVES. Vols. I. and II. By John Burroughs, John Muir and George Bird Grunnell. New York: Doubleday, Page & Co. 1901. Pp. 383. Price $15 net.

The present portly volumes are a very choice example of the bookmaker's art. They are beautifully printed and bound and the illustrations are of a high order and are well executed, and the color work being especially fine. It is a book which will appeal to all students of travel and exploration and natural history. The Harriman expedition was one of those happy thoughts which sometimes occur to those whose position enables them to benefit the world at large by the outfitting of such an expedition. The papers are all written either by three authors, or by specialists such as Professors B. E. Fernow, Henry Gannett, C. Hart Merriam and William Healy Dall. The scientific aspect of the expedition is never forgotten for a moment, and the collaboration of these eminent scientific men has resulted in a unique contribution to scientific literature which will prove of permanent value. The book is withal very readable.

MUNICIPAL ADMINISTRATION. By John A. Fairlie, Ph.D. New York: Macmillan & Co. 1901. 8vo. Pp. 448. Price $3.

Cities are the mark of civilization advancing beyond the stage of self-sufficing agricultural villages. They bring forward entirely new problems, and how to treat them has been the study of thousands who are called upon to govern our cities. Some of them are wisely governed, and some the reverse, but there is no question that a book like the present, placed in the hands of the mayors of cities, would prove its great worth. The whole organization of the city is taken up, and each phase of the subject is discussed in a broad and rational manner.

RECOVERY WORK AFTER PIT FIRES. By Robert Lamprecht. New York: The D. Van Nostrand Company. 1901. Pp. 171; 7 plates. Price $4.

The above volume is the result of long experience in various mines in different parts of the world. It is a practical mining work. The author, after an introductory chapter giving the causes of fires in coal mines, devotes the remainder of his book to preventive regulations, methods of extinguishing, appliances for working in irrespirable gases, and means for rescuing imprisoned miners.

THE RISKS AND DANGERS OF VARIOUS OCCUPATIONS AND THEIR PREVENTION. By Leonard A. Parry, M.D., F.R.C.S. New York: The D. Van Nostrand Company. 1901. Pp. 192. Price $3.

This work sets forth the essential risks and dangers of the most important English industries, the mode of onset of diseases caused by some of them, together with the chief symptoms, and measures which may be taken by employers and employés to prevent such diseases. As most of the industries mentioned are followed in America also, the book is to be commended to our employers of labor and workmen.

GAS AND COAL DUST FIRING. By Albert Pütsch. Translated from the German by Charles Salter. New York: The D. Van Nostrand Company. 1901. Pp. 122; 103 illustrations. Price $3.

This work is a complement of the author's two previous treatises on the subject, which dealt with gas-firing and smoke-consuming devices that had been patented up to 1885. It is a critical study of the various patented systems from that time up to the present, reviewing what has been done in this field and closely examining the practical importance of the different patented devices for burning this fuel.

ENGINEERING PRACTICE AND THEORY. By W. H. Wakeman. New Haven, Conn.: Published by the author. 1901. Pp. 170; 28 illustrations.

The author describes the various types of modern compound engines and gives thorough instructions for the engineer as to their handling and care. The book is a valuable one for engineers and others who have the care of steam engines.

MANUAL OF ELEMENTARY SCIENCE. By R. A. Gregory and A. V. Simmonds. London and New York: Macmillan & Co. 1901. Pp. 425; 260 illustrations.

This book was designed with the purpose of providing a repertory of experiments illustrative of the fundamental principles of physical, chemical, and astronomical science. It contains numerous experiments capable of being performed with simple apparatus by students and teachers unfamiliar with laboratory methods. It is divided into numbered sections corresponding to definite ideas, various aspects of which are first illustrated by experiment, and then dealt with descriptively. This method has also been carried out as far as possible in the astronomical part of the book, and is, so far as we know, the first attempt made at teaching astronomy inductively. The book is furnished with suitable exercises and questions, and will be of service to all beginners in science.

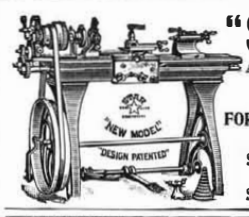
TECHNICAL GAS ANALYSIS. By Frank H. Bates. Philadelphia: Philadelphia Book Company. 1901. 16mo. Pp. 98. Leather. Price $1.

The first of a series to be known as The Industrial Gas Series. The author is an expert of the subject, and the book seems to be an eminently practical discussion of a somewhat difficult subject.

CONDUIT WIRING AND ERECTION. By L. M. Waterhouse. London: S. Rentell & Co. 16mo. Pp. 66.

AN INTRODUCTION TO MODERN SCIENTIFIC CHEMISTRY. By Dr. Lassar-Cohn. Translated by M. N. Pattison Muir, M.A. New York: D. Van Nostrand Company. 1901.

This work is in the form of popular lectures suited for University extension students and general readers. The book can be followed easily by anyone who takes a serious interest in natural science. It gives a succinct and accurate presentation of chemistry on strictly scientific grounds. The illustrations are execrable.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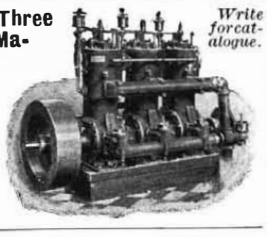
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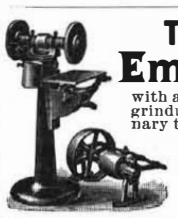
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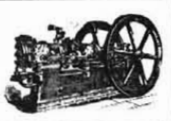

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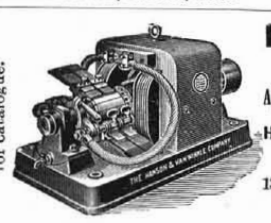
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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(8555) W. S. asks: Is it possible to consume all the oxygen in a confined quantity of air, viz., in a sealed iron pipe? A. Yes; by placing copper scraps in the pipe and heating the air in the pipe. The oxygen combines with the copper, forming a solid substance, and leaving the nitrogen uncombined.

(8556) M. J. M. asks: 1. I have a folding camera 4 x 5, with lens 1 5-16 inches in diameter. Can I use it for a 5 x 7 camera? A. To cover a 5 x 7 plate a lens with a focal length of about 8 inches is used. 2. How can I remedy a ground glass which has become blurred and spotted by water and breathing on it? A. Wash it with soap and water, and afterward do not handle it. 3. Is there any paste made that can be used on squeegeed prints that has but little water or moisture in it, for it will spoil the print? A. There are many formulas in the photographic books for pastes or mountants made of gelatine. These do not penetrate the paper very much. 4. Can you give me the formula for flash-light powder? A. Flash-light powder is finely powdered magnesium. You should buy it from photographic dealers. 5. Will you please tell me what is the matter with my intensifying solution. I made it as per directions, but after it had stood several days it became crystallized at the bottom and shaking would not dissolve it. A. The water is saturated with the substances employed in the formula. Filter the solution. It is not injured by the crystals. 6. I have a lot of trouble with my exposure. I cannot always time it just right. Which would be the best for me to do—to get an exposure meter or an exposure book in which I would have to register every exposure? A. Nothing but experience and a careful study of the light can enable you to expose properly. You cannot become a photographer by the use of a meter or a book. It is, however, well to record the conditions of our exposures, so that we may study them and improve by our experience. Keep an exposure book by all means. 7. I wish to become proficient in the art of photography. What book or books would you advise me to procure to advance in that direction? A. We recommend and can supply you with the following books relating to photography: "The Amateur Photographer," by Wallace, price $1: "A Manual of Photography," by Brothers, price $6, post free. 8. Is there any way to burnish my prints and keep the card from curling without a burnisher? A. We do not know of any way of burnishing without a burnisher. Most amateurs use paper which has no gloss, such as velox, platinotype, bromide, etc. 9. Is it necessary to have a license to sell pictures? A. Some cities may require a license for selling anything. We do not think a license is required to sell a photograph any more than to sell a penny whistle you may have made. 10. Can you give me the address of some firm that has good lenses? A. See our advertising columns for addresses.

(8557) C. M. writes: 1. I want to use a call bell in kitchen, battery to be in second story, from which run two wires. I want one push button in one room, one in second room, one in parlor, one in room down stairs, also one in dining room—five push buttons; how could I connect all buttons to work properly with only one bell? A. Carry one wire from one post of the battery to the bell, and from the other side of the bell a wire which shall branch through each push button to the other side of the battery. There will then be a complete and separate circuit through battery, bell and a push button. 2. I have one lamp, 8 candle power, 26 volts; could I light it with 14 cells improved standard Fuller battery? If so, how about the amperes it will use with 26 volts? A. You probably can light the lamp when the battery is freshly charged. 3. How old is Mr. Edison? Also, who was the first that invented the electric light? I mean both the arc and incandescent lamp? A. Mr. Edison was born February 11, 1847. The first man who ever saw a spark from artificially excited electricity is said to have been Otto von Guericke in 1660. This was the first electric light. Sir Humphry Davy is credited with first producing an electric arc light in 1801. He had a battery of 3,000 plates, each four inches square, and used charcoal points

(Continued on page 214)

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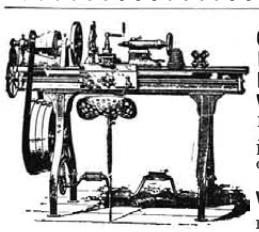

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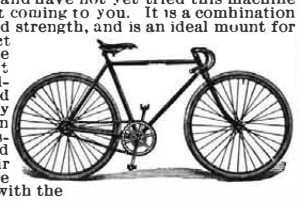

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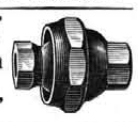

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made of wood, which he immersed in a mercury bath to increase the conductivity. With this he melted many refractory substances, lime, platinum, sapphire, diamond. The man who first heated a wire red hot had the first incandescent lamp. We do not know who he was.

(8558) H. E. G. asks: 1. What causes the humming sound heard at the receiver of a 'phone during a long-distance connection (New York to Philadelphia)? A. The running of the dynamo at central by which the system is worked. 2. Would not an alternating current (high tension) circuit parallel to 'phone wire have a tendency to cause such effect? A. Yes. The transposing of the line wires on the poles destroys the induction effect from currents upon parallel lines. 3. What is the object of transposing telegraph circuits? Are they affected by induction? A. The effect of transposing line wire is as given above, in answer to question 2. 4. Why did such a long time elapse between the discovery of electro-magnetic induction (1831) and the invention of the dynamo (1867)? A. The world was not ready for it. 5. Are single-phase alternating current circuits ever operated on the three-wire system of distribution? A. We do not know whether this has ever been tried.

(8559) J. H. L. asks: I have a long-distance telephone in my office. A portion of the day the office is locked and I am engaged in another room about one hundred feet distant, where I cannot hear the bell ring. How can I arrange to hear the signal in the latter room without having a second long-distance 'phone installed? Can I fix up a separate two-battery call telephone that will transmit the sound from one room to the other, thus notifying me that the bell is ringing? A. You can have a second bell put in so that the call shall ring in both places all the time. Or you can switch out the second bell when you do not wish it to ring. Many physicians have such an arrangement for night calls, placing the extension bell in their sleeping room.

(8560) J. T. H. asks: 1. If you rub with flannel a stick of sealing-wax held in the hand, it becomes electrified. If similarly you rub a rod of brass it does not become electrified. Explain the differences. A. The wax is an insulator, the brass is a conductor, and its electricity flows off as fast as it is generated. Insulate the brass and it can then be charged. 2. Is it possible to obtain a magnet with a single pole? A. No. 3. Can you magnetize a steel ball, 3 inches in diameter, and where is the equator? A. Yes. If symmetrically magnetized, the equator will be at the largest place between the two poles and equidistant from them.

(8561) W. F. R. writes: Is it not a fact that wireless telegraphy was known and practiced (experimentally) as much as fifteen to twenty-five years ago? I remember reading (I think in SCIENTIFIC AMERICAN) of some one who succeeded in sending a message a distance of eleven miles between mountain peaks in Virginia. A. Wireless telegraphy has been known much more than twenty-five years. Between 1840 and 1850, Prof. Joseph Henry made this record in a published paper: "A single spark from the prime conductor of a machine of about an inch long, thrown onto the end of a circuit of wire in an upper room, produced an induction sufficiently powerful to magnetize needles in a parallel circuit of iron placed in a cellar beneath, at a perpendicular distance of 30 feet, with two floors and ceilings, each 14 inches thick, intervening." This was not the sending of a message, but the man who did this was not far from sending messages in the same way. He also placed a coil 5½ feet in diameter against a door and at a distance of 7 feet from another coil of 4 feet diameter. Shocks were felt in the tongue from the terminals of the second coil when the circuit of a battery of eight cells was broken in the first coil. This was sending signals with the tongue as a receiver. In 1885 Mr. L. J. Phelps installed a system of telegraphing to trains on the railway between Mott Haven and New Rochelle, N. Y. The message was sent along a wire between the rails and received in the baggage car of the moving train, wherever it happened to be along the line. This was soon replaced by the Edison system, and this was employed by the Lehigh Valley Railroad in running its trains. A man who was connected with this system has recently stated in print that he had received messages by it at a distance of 10 miles from the line, using a wire fence to receive with. In subsequent experiments the same writer states: "A large induction coil similar to that used by Marconi was used, and 10 to 20-mile messages were of common occurrence."

(8562) T. W. B. asks: Can you inform me what length secondary spark it would be necessary to have in order to transmit wireless messages to a distance of 2½ miles overland, using other apparatus described in SUPPLEMENT 1363? I have about 45 feet elevation for radiators. Can you refer me to a SUPPLEMENT giving directions for constructing such an induction coil? A. We do not know the exact length, nor do we advise anyone to build a coil which would only give the exact length for the distance he supposes at present he will send a message. It is better to have a reserve of power at hand. We should not

(Continued on page 215)

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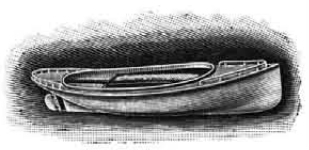

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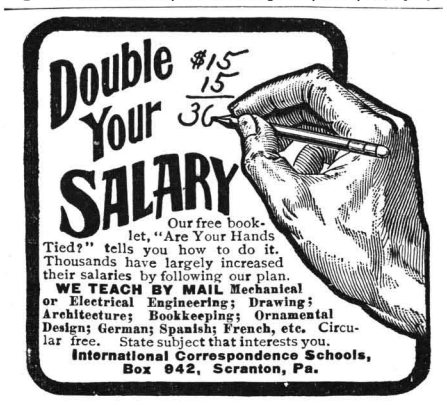

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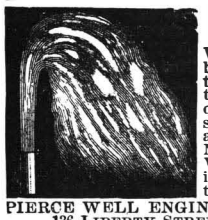

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think of making a coil with less than a six-inch spark. Such a coil is described in SUPPLEMENT No. 1124, price ten cents.

(8563) A. B. asks: 1. Why are magneto calls used on telephones instead of the common make and break bells? A. The magneto machine generates a current well adapted to ringing the bell. No battery is required. It is less liable to get out of order than if a battery were employed to ring the bell. 2. Is the armature of a magneto bell a permanent magnet? If not, please state what causes it to vibrate. A. The bell has a polarized armature. This is a permanent magnet, which moves the instant the current varies the magnetism around it. It works more easily than a bell with a battery could do. All such matters are fully explained in Webb's "Telephone Handbook," price $1 by mail.

(8564) H. L. B. asks: How much No. 36 wire will it take for the secondary of a coil giving a one-inch spark, and how much and what size wire for the primary coil to be used for wireless telegraphy? A. It is a very good coil which gives an inch of spark for a pound of secondary. For primary coils from 12 to 16 wire may be used.

(8565) J. R. F. asks: 1. What amount of weight can be lifted with a pound of metal charged with lodestone as heavily as it can be charged? A. There is a great difference in the weight lifted by permanent magnets. You will do well if you lift a pound with a magnet weighing as much as a pound. Nor can you magnetize a bar magnet well with lodestone. It should be magnetized with an electric current, if you would produce a strong magnet. 2. Does the metal charged lose its power to lift in time by using it. A. No; a magnet is not injured by working. If left with a keeper on its poles and handled with care, no loss of strength need take place. 3. Can cast iron be charged as well as any other metal? A. Steel is the only metal of which a permanent magnet can be made. The best tool steel should be used.

(8566) K. S. A. asks: Is there any method known by which a picture or outline can be thrown on a screen in daylight, on the principle of the magic lantern, without making the room dark? For instance, could the outline be thrown on as a shadow? A. A lantern slide can be thrown upon a screen in a room by daylight if an electric arc lamp is used for an illuminant. It will not be as distinct as if the room were darkened, but still it can be distinctly seen.

(8567) W. E. F. asks: What would be the apparatus necessary to charge a storage battery from a trolley wire of an electric railway, and what size battery for 5 horse power motor to run say 10 hours; and about what would the outfit cost, and how long would it take to charge it? A. You will require half as many storage cells to run your motor as the volts taken by the motor, since each cell will give 2 volts. To obtain the number of amperes you will need, divide 746 by the voltage of the motor. This gives the amperes for one horse power hour. Multiply this by 5 and by 10, and you will have the ampere hours required for 5 horse power for 10 hours. Now go to the electric railway company and ask them to fit you out to charge the battery. We do not know the cost, nor do we know exactly what you will need. But the engineer of the company will know.

(8568) L. E. A. K. asks: 1. Is the current that leaves a telephone in talking the battery or an induced current? A. An induced current. The induction coil is to be seen in the box of the transmitter in many forms of apparatus. 2. Are telephone generators alternating or direct current? A. The magneto generator by which the call bell is rung is an alternating current machine. 3. Can a direct current be transformed from a higher to lower or lower to higher without going through a rotary transformer? A. Yes; by an induction coil it is transformed to a pulsatory current in one direction.

(8569) C. C. McC. asks: Do you publish a work on the construction of voltmeters and ammeters that would enable one to construct one for use on an isolated plant? A. SUPPLEMENT No. 1215, price ten cents, will give information for the construction of a voltmeter and ammeter which may answer your purpose.

(8570) S. C. asks: 1. A party of us visited an electric plant. The electrician attached to the end of the poles of the dynamo two large pieces of iron, then inserted them into a saline solution, saying he would boil water, but I thought what he called boiled was only the decomposition of the water to $H_2 + O$. Am I correct? A. Both decomposition and heating of water takes place, and the water is soon heated to boiling. 2. The electrician said if the two pieces of iron at the end of the poles were to touch one another, it would blow up the dynamo. In that case what would cause it to blow up? A. If the plates were brought to touch each other, the resistance would be brought so low that an enormous flow of current would take place (Ohm's law), and this would heat the dynamo so that the wire would soon melt, unless there were a fuse which would blow and cut off the current. It would not be an explosion in any ordinary sense of the term, but a burnout. We cannot change your dates unless you send full address.

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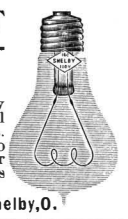

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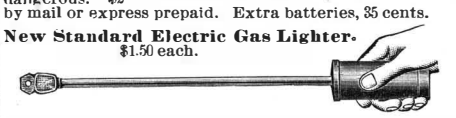

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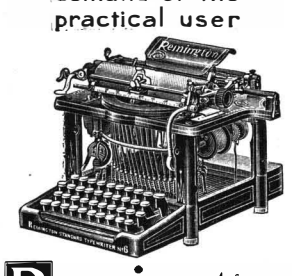

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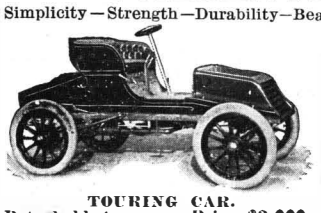

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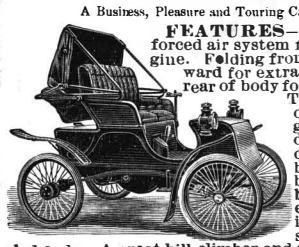

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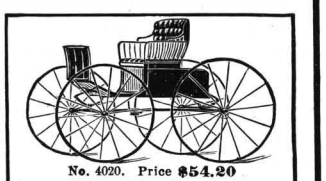

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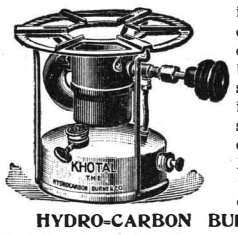

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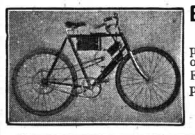

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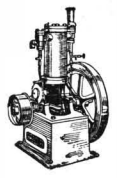

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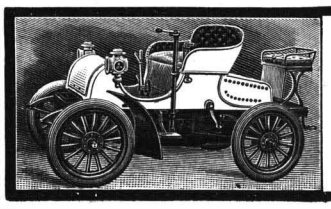

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